Dale W. Thurston
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Presented by

Dale Thurston, D. O.

COLLEGE OF OSTEOPATHIC PHYSICIANS
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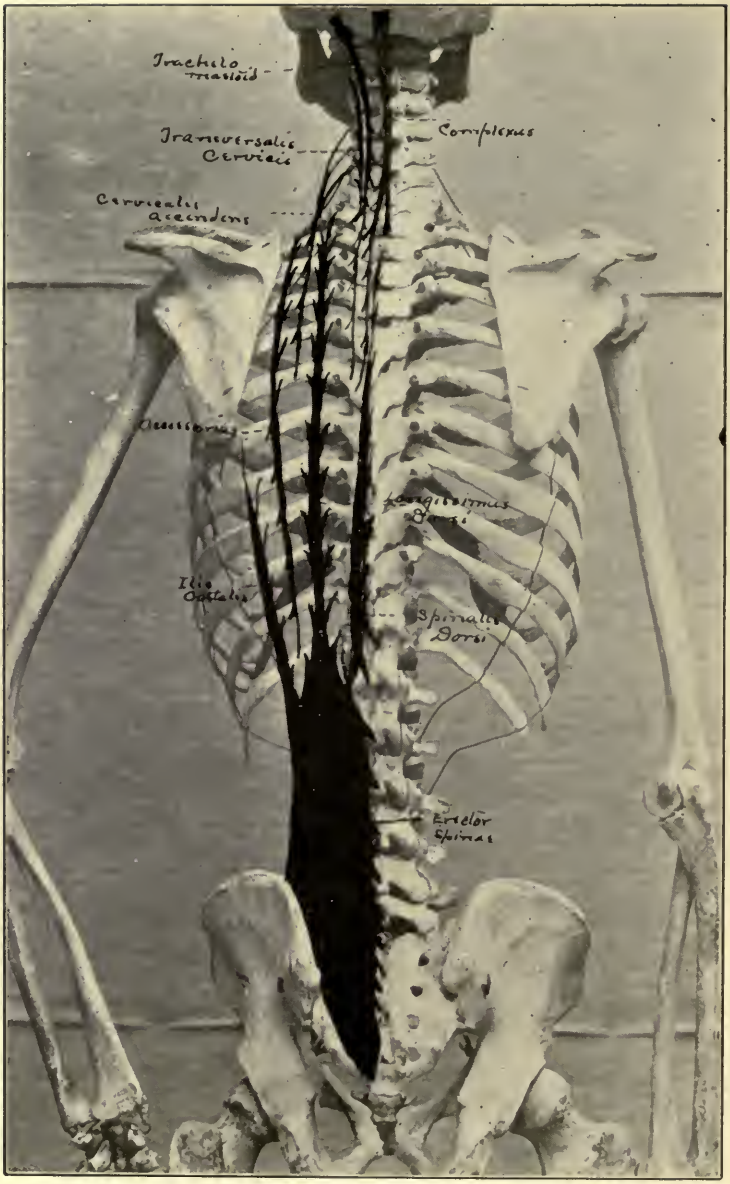

Fig. 95.—Diagram of dorsal muscles—4th layer. Adapted from a diagram in Cunningham's Anatomy.

PRINCIPLES OF OSTEOPATHY

By

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PREFACE.

This book on the *Principles of Osteopathy* is intended as a manual for the use of students and practitioners. There has been no effort on the part of the author to do more than give a short, terse exposition of the essential facts underlying osteopathy. Realizing fully the great effort required to keep pace with the rapid progress of medicine in general we have tried to include in our chapters only that which will be solid food for our readers. We have long since learned that the hurried student and busy practitioner have no time to read long dessertations on any subject. Time is an essential factor in covering the necessary studies of an osteopathic curriculum.

In order that the student may read these chapters intelligently he must have concluded at least ten months of study of Biology, Histology, Anatomy and Physiology. These subjects form the basis of the science of osteopathy.

The author has kept in touch with the growth of osteopathy from year to year, through careful perusal of its published books and periodicals.

The contents of this book are the condensed results of the author's study of recognized medical text books on Anatomy, Physiology, Histology, Pathology, Bacteriology and Diagnosis, of the works of the founder of Osteopathy, Dr. A. T. Still, Hazzard, Riggs, Henry and McConnell, of six years' experience in the clinics of the Pacific School of Osteopathy, and the Infirmary in connection with this college, and six years of continuous teaching, two of which were devoted to Anatomy and Physiology and the remaining four to Theory and Practice of Osteopathy and Physical Diagnosis.

To enumerate the books from whose pages facts have been gleaned for corroborative testimony concerning the Principles of Osteopathy is impossible. Books have been read and layed

aside and what is here written may be the result of something which caught the author's attention for a moment only and then became a maverick.

The illustrations to elucidate the text have been furnished principally by the laboratories and clinics of the Pacific School of Osteopathy. Without the hearty and efficient aid of my associates on the faculty of this college much of the concise detail of this book would have been impossible. I am indebted to several osteopathic physicians for drawings of histological tissues which they had prepared during their college work. They are given credit under their drawings.

The large number of excellent photographs of microscopic structures, patients and movements is the result of the skill of J. O. Hunt, D. O. A few of the photographs were made by M. E. Sperry, D. O., who also took great care to see that we had the best of photographic lenses with which to work. I am also greatly indebted to C. H. Phinney, D. O., and J. E. Stuart, D. O., for their accurate demonstration of osteopathic movements.

My thanks are extended to Miss Louisa Burns, B. S., for reading the manuscript and suggesting corrections therein, also to Miss Gertrude Smith for preparing the manuscript for the publisher.

DAIN L. TASKER, D. O., D. Sc. O.

PREFACE TO SECOND EDITION.

Three chapters have been added to the present edition. These fit logically into the work as it appeared in the first edition. Since Osteopathy is a rapidly developing school of medicine new conditions give occasion for a broader and more definite conception of the work of the Osteopath. In this second edition an effort has been made to correct the errors of the first and to add such matter as will bring the work up to date and maintain its standing as a concise exposition of the Principles of Osteopathy.

The author feels indebted to many kind readers who have called attention to typographical and other errors. Thanks are especially due Dr. C. A. Whiting for a careful criticism of the book. It is hoped the errors previously appearing have been practically eliminated.

Los Angeles, Calif., May 21st, 1905.

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INTRODUCTION.

Great strides have been made during the past twenty-five years in the practice of medicine. The relative positions formerly held by drug therapy and surgery have been completely reversed. The concoctions of the pharmacopoeia, with their vague and uncertain effects upon human tissues and functions, no longer entice the earnest seeker after medical truths to spend a lifetime experimenting with substances which are absolutely foreign to the human body.

There was a time, not far away, when that person who treated human diseases by manipulation, water, diet and general hygiene was considered to be the chief of impostors. Go a little farther back in the history of medicine and we see surgery dishonored because it was mechanical, not mystical enough for the ponderous minds whose forte it was to deal with strange substances of the animal, vegetable and mineral kingdoms.

During all the years in which drug-therapy flourished there were a few real scientists who devoted time and talents to the structure of our bodies and the function of each part. Discoveries came slowly along these lines because the majority of medical men were concentrating their energies on ferreting out the effects of drugs. Facts in anatomy and physiology which are so patent to us at this time, remained obscure for centuries simply because there was no thought of studying the form and action of tissues, while all nature outside of our own bodies seemed to be a grand laboratory of specifics for human ailments.

If osteopathy had been born fifty years ago, it would have died because the popular and scientific minds were not in a condition to receive it. Even the time at which it was born.

scarcely twenty-five years ago, was hardly ripe for this new departure in medicine. Ten years easily cover the period of its active history.

A Scientific Growth.—There is one distinctive point about osteopathy which should be especially emphasized: It is not an empirical system; nothing is done on the cut and try plan. It has been developed in a purely scientific way. We might observe the action of the human body in health and disease indefinitely without securing any exact data to pass on to the next generation of observers if we fail to know the structure of the body. A physician may learn many things in an empirical way which are very poor assets for science.

The strange part of medical history, to the modern investigator, is the fact that discoveries in anatomy and physiology, which are of such vital importance to the successful treatment of human diseases, were left stored away between the covers of books, not deemed of any value except to whet the mind of the dilletante in medicine.

Osteopathy as a distinct system of medicine has grown to its present proportions at a time when the older schools of medicine are making radical changes in their therapeutical procedures, e. g., serum-therapy. In spite of all these so-called scientific advances in drug-therapy, osteopathy has made steady advance into public favor, thereby showing that it is fully able to compete with the older systems of practice.

The Founder of Osteopathy.—Dr. A. T. Still, of Kirksville, Mo., is the honored founder of this system of therapeutics. His early work was of that persistent, plodding character which is necessary in order to build a firm foundation for accurate observation in later years. He did not sit and listen to flowing sentences from the mouths of lecturers, and straightway assert that certain things are causes of disease. His work was in studying the structure of our bodies directly, and thus gain an accurate knowledge of how bones, ligaments and muscles, blood-vessels, glands and nerves are placed. Then he sought that department of knowledge which we call physiology, and learned how these tissues act in health. Having had previous training in treating diseases by the drug meth-

od, he was slow to discard the old method for one which had never been tried, even though it had good scientific reasons back of it. But the substitution did take place by degrees until his system of therapeutics no longer made use of drugs.

It seems to be a popular idea that it is necessary for the founder of a system to have a creed or statement of belief. We do not doubt but that it is good for us at times to try to put our beliefs in writing, not to form a fixed position, but just as the architect draws many plans to gradually develop his mental pictures. These statements usually contain the truth about our work so far as we know it. We can thus see how far we have advanced and realize that we have much to learn.

Dr. Still has, from time to time, expressed the result of his studies, that is, the observed facts upon which he has built his system of therapeutics. In 1874, Dr. Still stated his observations as follows: "A disturbed artery marks the period to an hour, and minute, when disease begins to sow its seeds of destruction in the human body. That in no case could it be done without a broken or suspended current of arterial blood which, by nature, is intended to supply and nourish all nerves, ligaments, muscles, skin, bones and the artery itself. * * *The rule of the artery must be absolute, universal, and unobstructed, or disease will be the result. * * * All nerves depend wholly upon the arterial system for their qualities, such as sensation, nutrition and motion, even though by the law of reciprocity they furnish force, nutrition, and sensation to the artery itself."

Definitions.—Many definitions have been formulated and published to the world. Each one tends to limit one's conception of osteopathy in some particular. A definition always limits the thing defined, therefore, no definition of osteopathy can be complete, because we are dealing with a principle, the universality of which no one knows. Whereas, less than seven years ago, it was thought that osteopathy was an excellent method of treating chronic ailments, we now find osteopaths working day and night at the bedside of the acutely sick. Thus does it spread and become thoroughly recognized as a system applicable to all diseases.

In order to bring before the student as full and comprehensive an idea of the scope of osteopathy as possible, a series of definitions are quoted. These definitions have been taken from current osteopathic literature and are credited to their respective authors.

One of the short paragraphs in Dr. Still's autobiography is sufficient to give a clear understanding of his idea of the human body. "The human body is a machine run by the unseen force called life, and that it may be run harmoniously, it is necessary that there be liberty of blood, nerves and arteries from the generating point to destination."

The following definition is one which has been used in the American School publications for a long time: "Osteopathy is that science which consists of such exact, exhaustive and verifiable knowledge of the structures and functions of the human mechanism, anatomical, physiological and psychological, including the chemistry and physics of its known elements as has made discoverable certain organic laws and remedial resources, within the body itself, by which nature, under the scientific treatment peculiar to osteopathic practice, apart from all ordinary methods of extraneous, artificial, or medicinal stimulation, and in harmonious accord with its own mechanical principles, molecular activities, and metabolic processes, may recover from displacements, disorganizations, derangements, and consequent disease, and regain its normal equilibrium of form and function in health and strength." Mason W. Pressly, A. B., Ph. D., D. O.

"Osteopathy is that science of healing which emphasizes, (a) the diagnosis of disease by physical methods with a view to discovering not the symptoms but the causes of diseases, in connection with misplacements of tissue, obstruction of the fluids and interference with the forces of the organism; (b) the treatment of diseases by scientific manipulations in connection with which the operating physician mechanically uses and applies the inherent resources of the organism to overcome disease and establish health, either by removing or correcting mechanical disorders, and thus permitting nature to recuperate the diseased part, or by producing and establishing antitoxic

and antiseptic conditions to counteract toxic and septic conditions of the organism or its parts; (c) the application of mechanical and operative surgery in setting fractured or dislocated bones, repairing lacerations and removing abnormal tissue growths or tissue elements when these become dangerous to the organic life." J. Martin Littlejohn, LL. D., M. D., D. O.

"Osteopathy is a school of mechanical therapeutics based on several theories. 1. Anatomical order of the bones and other structures of the body, is productive of physiological order, i. e., ease or health in contradistinction to disease or disorder which is usually due, directly, or indirectly, to anatomical disorder. 2. Sluggish organs may be stimulated mechanically by way of appropriate nerves (frequently by utilizing reflexes) or nerve centers. 3. Inhibition of over-active organs may be effected by steady pressure substituted for the mechanical stimulation mentioned above. 4. Removal of causes of faulty action of any part or organ is the keynote of the science." C. M. Case, M. D., D. O.

" . . . . . Thus the word (osteopathy) has come to mean that science which finds in disturbed mechanical relations of the anatomical parts of the body the causes of the various diseases to which the human system is liable; that science which cures disease by applying technical knowledge and high manual skill to the restoration of any or all disturbed mechanical relations occurring in the body." Chas. Hazzard, Ph. B., D. O.

"Osteopathy means that science or system of healing which treats diseases of the human body by manual therapeutics for the stimulation of the remedial and resisting forces within the body itself, for the correction of misplaced tissue and the removal of obstructions or interferences with the fluids of the body, all without the internal administration of drugs or medicines." Chas. C. Teall, D. O.

"Osteopathy is that school of medicine whose distinctive method consists in (1) a physical examination to determine the condition of the mechanism and functions of all parts of the human body, and (2) a specific manipulation to restore the

normal mechanism and re-establish the normal functions. This definition lays stress (1) upon correct diagnosis. The osteopath must know the normal and recognize any departure from it as a possible factor in disease. There is not one fact known to the anatomist or physiologist that may not be of vital importance to the scientific osteopath. Hence a correct diagnosis based upon such knowledge is half the battle. Without it scientific osteopathy is impossible and the practice is necessarily haphazard or merely routine movements. The definition lays stress upon (2) removal of the cause of disease. A deranged mechanism must be corrected by mechanical means specifically applied as the most natural and only direct method of procedure. This work is not done by any of the methods of other schools. After the mechanism has been corrected little remains to be done to restore function; but stimulation or inhibition of certain nerve centers may give temporary relief and aid nature. The adjuvants used by other schools, such as water, diet, exercise, surgery, etc., are the common heritage of our profession and should be resorted to by the osteopath if they are indicated." E. R. Booth, Ph. D., D. O.

"1. Osteopathy is a physical method of treating disease without drugs.

2. Osteopathy is applied physiology.

These two definitions refer to osteopathy in its broad sense.

3. The cell is the unit of the body which inherits its vitality. This vitality is kept up by pabulum received from the blood, while the waste is carried away by the lymph and venous streams.

The differentiated cell to be able to trophize properly must receive a nerve. Every cell has the inherent capacity to recuperate after injury, and as the nervous system controls the circulation of the blood, it follows that any abnormality of position or size of any tissue or any change in the chemical constitution of a tissue leads to disease.

The nervous system yields most readily to mechanical stimuli, therefore osteopathy is the art of treating disease by

physical and mechanical means; the science of aiding the vital processes by means of stimulation or inhibition of nerves, and by the removal of lesions or obstructions." J. W. Hofsess, D. O.

"Osteopathy is a complete system of healing, wherein only food and water is allowed to enter the stomach, and all natural means are employed to place a diseased body under such conditions as will permit nature to effect a cure, including the most effective dietetic and hygienic measures, such as suggestion, fasting, exercise and hydrotherapy; special use being made of manipulations that normalize the tonicity of muscles, the flow of blood and lymph, the transmission of nerve force and the functioning of bodily organs by replacing deranged anatomical structures, stretching and pressing muscles, vessels and nerves, freeing the movements of joints and correcting dislocations and subluxations." C. W. Young, D. O.

"Osteopathy is that science or system of healing which, using every means of diagnosis, with a view to discovering, not only the symptoms, but the causes of disease, seeks, by scientific manipulations of the human body, and other physical means, the correcting and removing of all abnormalities in the physical relations of the cells, tissues and organs of the body, particularly the correcting of misplacements of organs or parts, the relaxing of contracted tissues, the removing of obstructions to the movements of fluids, the removing of interferences with the transmission of nerve impulses, the neutralizing and removing of septic or foreign substances from the body; thereby restoring normal physiological processes, through the re-establishment of normal chemical and vital relations of the cells, tissues and organs of the body, and resulting in restoration of health, through the automatic stimulation and free operation of the inherent resistant and remedial forces within the body itself." C. M. Turner Hulett, D. O.

"Osteopathy is that science which reasons on the human system from a mechanical as well as a chemical standpoint, taking into consideration in its diagnosis, heredity, the habits

of the patient, past and present; the history of the trouble, including symptoms, falls, strains, injuries, toxic and septic conditions, and especially in every case a physical examination by inspection, palpation, percussion, auscultation, etc., to determine all abnormal physical conditions; the treatment emphasizing scientific manipulation to correct mechanical lesions, to stimulate or inhibit and regulate nerve force and circulatory fluids for the recuperation of any diseased part, using the vital forces within the body; also the habits of the patient are regulated as to hygiene, air, food, water, rest, exercises, climate and baths, such means as hydropathy, electricity, massage, antidotes and antiseptics, and suggestion sometimes being used as adjuncts." Chas. C. Reid, D. O.

"Osteopathy is a method of treating disease by manipulation, the purpose and result of which is to restore the normal condition of nerve control and blood supply to every organ of the body by removing physical obstruction, or by stimulating or inhibiting functional activity as the condition may require." Wilfred L. Riggs, D. O.

"Osteopathy is a system of medicine, characterized by close adherence to the physiological axiom that perfect health depends on a perfect circulation, and perfect nerve control in every tissue of the body. Its etiology emphasizes physical perversions of tissue relations as causes of disease. Its diagnosis is mainly dependent on the discovery of physical lesions by means of palpation. Its therapeutics comprehends (1) manipulation, including surgery, for purposes of readjusting tissue relations; (2) scientific dietetics; (3) personal and public hygiene." Dain L. Tasker, D. O.

The above definitions have nearly all been taken from the Journal of the American Osteopathic Association.

Osteopathic Diagnosis.—Physical diagnosis is and always will be the leading factor in the success of osteopathic practitioners. This ability to take hold of an ailing human being and detect the disturbing factor in it, is the highest attainment of the physician. Osteopathy has developed the art of palpation to a wonderful degree. Basing this art on a definite knowledge of structure and function makes it the chief reliance

in diagnosis. Every physical diagnosis begins with palpation and proceeds with auscultation and percussion, and not failing to use chemical and microscopical methods when necessary. The student must learn to use his sense of touch continually, in fact, learn to see with his fingers. Add to this development of touch a training in chemical and microscopical analysis of secretions and excretions of the body, and we have a practitioner thoroughly equipped to make an accurate scientific diagnosis.

Osteopathic Therapeutics.—Osteopathic treatment is based on this kind of physical diagnosis which we have just described. It takes into account the fact that the organism is a self-recuperating mechanism and requires proper food, proper surroundings, and perfect activity of every tissue, especially the blood. Thus we divide treatment into three divisions, (1) manipulation for the purpose of correcting the mal-position of any tissue, whether that tissue be bone or blood; (2) proper feeding, i. e., dietetics; and (3) proper surroundings, i. e., hygiene.

If the condition of the body is such that none of the three methods just mentioned will right the difficulty, i. e., if there are broken bones, ruptured muscles and connective tissues or false growths, we can then use surgical means. Surgery is a part of the osteopathic system, just as it is of all systems of medicine. The chief assurance lies in the fact that the osteopathic system is very conservative as regards the use of the knife.

Osteopathy includes all those qualities which make up a successful system; its diagnosis is accurate and its treatment is comprehensive, including scientific manipulations, scientific dietetics, hygiene and surgery.

In a recent article in the American Monthly Review of Reviews, the following sentences appear: "With but few exceptions, the entire vegetable and mineral kingdoms have given us little of specific value; but still, up to the present day, the bulk of our books on materia medica is made up of a description of many valueless drugs and preparations. Is it not to be deplored that valuable time should be wasted in our

student days by cramming into our heads a lot of therapeutic ballast."

This is probably the most recent statement of this kind in the public prints. It substantiates the position taken by the osteopathic colleges. We feel justified in claiming that osteopathy today occupies a position which every other system of medicine must come to sooner or later. It is broad enough and liberal enough to accept truth wherever demonstrated. Its foundations being laid in the basic sciences, and its treatment never departing from the facts of these sciences, make it a system of lasting worth and capable of adding an entirely new conception of the phenomena of life to medical literature.

The formation of the name osteopathy (from *osteon,* bone, and *pathos,* suffering) seems to be as perfect a descriptive name as it is possible to form which would cover the basic principle of the science. The bones are the foundation upon which all the soft tissues are laid, and the osteopath makes all his examinations, using them as fixed points from which to explore for faulty arrangement. The name does not mean bone disease, but since the osteopath finds many diseases resulting from pressure due to slightly displaced bone, the name is used in the sense of disease caused by bone. We do not consider that all diseases are caused by displaced bone, but it is a cause which has heretofore been overlooked. We recognize that there are many causes of disease, and do not wish to be understood as trying to fit fact to theory, but as a result of observing certain facts, this basic principle of osteopathy has been made clear.

We believe that health is the natural state, and that this condition is bound to be maintained so long as every cell has an uninterrupted blood supply, and its controlling nerve is undisturbed. Therefore, the first effort of the osteopath is to remove all obstructions to blood and nerve supply, feeling certain that when these obstructions are removed, health will follow. Hilton in his lectures on "Rest and Pain," which are considered medical classics, has expressed himself forcibly on this subject, as follows: "It would be well, I think, if the

surgeon would fix upon his memory, as the first professional thought which should accompany him in the course of his daily occupation, this physiological truth—that nature has a constant tendency to repair the injuries to which her structures may have been subjected, whether those injuries be the result of fatigue or exhaustion, of inflammation or accident. Also that this reparative power becomes at once most conspicuous when the disturbing cause has been removed; thus presenting to the consideration of the physician and surgeon a constantly recurring and sound principle for his guidance in his professional practice."

Every system of curing human ills, which is based on the known facts of anatomy and physiology will last, because it is true. When systems of drug medication are known only as history, osteopathy will be ministering to the human race, because it knows no other path than that which leads to greater truths in physiology and anatomy.

CHAPTER I.

THE CAUSE OF DISEASE.

Potential and Kinetic Energy.—The cause of disease is in the cells of the body. They contain the stored energy, i. e., potential energy. When this potential energy is released by some other force, or stimulus, we have kinetic energy. Potential energy cannot transfer itself spontaneously into kinetic energy without first being affected by some other force which may be called a stimulus. The amount of potential energy converted into kinetic is not proportional to the amount of the stimulus used to initiate the process. All stored energy, i. e. potential energy, requires a certain strength of stimulus to start the process of conversion into kinetic. When this strength of stimulus is known it is called the normal. There are usually several kinds of stimuli, each one having a varying degree of intensity. For example, the potential energy in a muscle fiber will be converted into kinetic energy as a result of mechanical, thermal, chemical or electrical stimuli. Certain amounts of each of these stimuli are required to initiate the change in the form of energy.

A Normal Stimulus.—The potential energy in a muscle fiber has a certain degree of resistance to stimuli. A definite amount of any one of the four forms of stimuli named is necessary to cause the muscle fibre to contract. This definite amount, which is capable of stimulating the muscle to an average contraction is called the normal stimulus, and the action of the muscle is called the normal contraction. If the muscle should contract more vigorously than usual in re-

sponse to this normal stimulus, the resistance of the potential energy of the muscle fibre is below normal. The strength of stimulus and discharge of energy may vary greatly in their proportions within normal limits, but there are well marked lines above or below which resistance is spoken of as above or below normal.

A Change of Resistance.—When the resistance of the potential energy is below normal, a normal stimulus causes too great an effect, that is, too much potential energy is transferred into kinetic energy. When the resistance of the potential energy is normal, and the stimulus above normal, there also results an excessive discharge of potential energy. Therefore, excessive discharge results from lowered resistance, or increase of stimulus.

Resistance.—Resistance is a quality of the cell protoplasm. The stimulus is an external force.

The cell depends on proper surroundings in order to maintain its resistance to external stimuli, such as bacteria. The strength of bacteria may also be increased or decreased by the nature of their surroundings.

Cause and Effect.—After potential energy has been changed into kinetic energy, this latter may generate more potential energy, and this also may be converted into kinetic. Thus cause is converted into effect and effect into cause. This is an endless chain. When such a process is beyond the normal, as in the body when varying symptoms present themselves, therapeutic efforts must be concentrated on some one particular reflex in order to break the chain.

Cell Relations.—The relations of a cell with its fellows that is, its structural relations, are the basis upon which its resistance, in large measure, depends. Therefore, anything which disarranges its normal relations will, in all probability, change its resistance to stimuli. All therapeutic methods which aim at lessening the too rapid conversion of potential into kinetic energy, that is, increasing cell resistance, must see that correct structure is attained.

Excessive Stimulation.—In cases where almost complete exhaustion of potential energy has resulted from lowered

resistance and we find that even increased strength of stimulus fails to evoke a response, the same structural fault may exist. We know that stimulation, when excessive, passes into inhibition. Perhaps it is truer to state that over activity of a cell leads to exhaustion of its potential energy. The stage of exhaustion, in this sense, is consonant with inhibition. As an example: In case of structural changes in the lumbar region, there may result a change in resistance in the secretory and contractile cells of the intestines due to changed blood supply. Diarrhoea results for a time, followed by constipation. At the beginning of the rapid conversion of potential into kinetic energy the muscles feel tense. After the constipation, or period of exhaustion, sets in, they are flabby.

Structural Defects.—Structural defects may result in lowered resistance in groups of cells. They also act as stimuli to set free the potential energy in these cells. In many cases we note only a predisposition to yield to weak stimuli. This is the condition in individuals who are "fairly well," but cannot endure any of the normal stimuli in average amount. They cannot exercise freely without a bad reaction. A slightly heavier meal than usual; the excitement due to the presence of many people arouses "symptoms." Their physiological processes are easily perverted by normal stimuli because a structural defect, either directly or indirectly, has decreased cell resistance. Cases of lowered resistance, supposed to be due to heredity, should be carefully examined for structural defects. It is not improbable that many an ancestor is wrongly accused of transmitting a "predisposition."

While cell resistance remains below normal, all external stimuli, such as atmospheric changes and presence of bacteria, even if in only normal amounts, may call forth "symptoms of disease."

Cell Life Dependent on Circulation.—The individual cells of the body depend on the supply of nourishment brought to them by the circulating fluids of the body. The protoplasm of the cells is a complex, chemical substance made up of an enormous number of complex molecules. These molecules, on account of the looseness of combination of their atoms, require

sufficient crude material brought to them to maintain the proper atomic tension. Upon this tension is based the resistance to normal or abnormal stimuli.

The necessary food for cell protoplasm is brought to the cells by blood and lymph. Since cell protoplasm is entirely dependent upon the circulating media, any disturbance of these media changes the metabolism of the cell, and hence a change in resistance results. This resistance may be varied by failure on either the arterial or venous side of the general circulation, resulting in changed lymph circulation. The constant removal of katabolic products is of as much importance as the constant renewal of material for anabolism.

Intracellular tension, i. e., the cohesiveness of the atoms of each molecule, is dependent on lymphatic circulation, this upon arterial and venous circulation. If there is abnormal variation in any of these circulatory fluids, there results a change in resistance of the cells. Therefore a normal stimulus may provoke too great a transference of potential into kinetic energy and thus initiate a chain of such transferences of one form of energy into another. As a rule, the kinetic energy which results from the release of potential energy in excessive amounts acts as a stimulus to release still more potential energy and so on to the point of exhaustion of the supply of such stored energy. This change is exemplified in the series of symptoms which appear in many diseases. Each liberation of a new supply of energy gives rise to a new symptom. If the potential energy resides in a gland, excessive secretion results; if in muscle, excessive contraction, etc. The way in which the kinetic energy is manifested depends upon the manner in which its cause, i. e., potential energy, is stored. The secretion or the contraction may act as a stimulus to liberate still more potential energy.

Osteopathic Therapeutics.—Therapeutics of osteopathic medicine are addressed: First, to correction of structure with consequent increase of cell resistance to stimuli; second, to reducing the intensity and power of external stimuli to or below normal.

"In no case can anything appear in the form of disease

which was not previously present in the body as a predisposition; external forces are able merely to make this predisposition apparent. . . . When the physician, by thorough observation and investigation, knows the conditions that influence a given predisposition in a definite way, when he is scientifically trained and has a true conception of hygiene, and is at once physician and naturalist, then he is able to cure disease by use of the very same forces which serve to create or alter the human constitution. In this simple sense there is a true art of healing." Hueppe's Principles of Bacteriology. Page 249.

It is therefore necessary that anatomy should hold the most important position among the studies requisite for a thorough understanding of osteopathic therapeutics. Physiology, the normal reaction of cells to normal stimuli, is next in importance. The study of external stimuli may be comprehended under the titles Hygiene and Bacteriology. Symptoms are the surface play of kinetic energy. They lead to a broad understanding of vital phenomena.

Incidents in the History of a Disease Process.—Other schools of medicine note uric acid or bacteria as causes of disease processes. Osteopathic etiology views these as incidents in the history of disease processes. The cause lies in the cells and their lowered resistance to normal stimuli. The condition of lowered resistance is viewed as a result of structural changes which interfere with the nerve control of the individual cells with the lymphatic circulation upon which the cells depend for nourishment. These changes strike at the very root of tissue life and resistance, hence open the way for external stimuli to cause too great a discharge.

The presence of bacteria is of little moment until cell resistance has been reduced sufficiently to allow them to grow and manufacture their poisonous products.

A fall or sprain may be responsible for a slight subluxation of a rib. This subluxation affects the nutrition of the cells forming the lungs, resistance is lowered. Bacilli of tuberculosis may be present in the inspired air. They find a fertile spot in this area of lessened resistance. Resistance

must be increased in this area in order to head off the disease process. Nature has two methods of overcoming the disease. First, she tries to eliminate it from the body; failing in this, she tries to compensate for it by throwing the burden of work on some other tissue, or again, to accommodate. We see compensation illustrated by increase of heart muscle in case of dilation. Accommodation is illustrated by forming a wall of connective tissue around a diseased area, thus practically eliminating that area from direct physiological activity with the rest of the body, even though it is actually within the body. This last process is to all intents and purposes, equivalent to the first, i. e., elimination.

Whether the illness be ascribed to uric acid or bacteria, there is something back of these which has been the cause. Some disturbance of the normal metabolism has resulted in the formation and retention of uric acid. We consider that some structural lesion, in the area of the spine from which the nerves of the gastro-intestinal tract emanate, must have disturbed the normal rythm.

When rheumatism of an extremity exists, we do not use salicylates, but we examine the structures which might affect the innervation and circulation of the extremity.

Fatigue—Excess.—Although structure is examined with the fact in mind that it may affect function, we do not forget the fact that function may affect structure. With this in view, we are interested in knowing what effects may have resulted from fatigue of any organ or the entire body, the effects of excess in eating, drinking or sexual intercourse.

We have stated that increase of normal stimuli may cause a lessened resistance. Thus indulgence in pleasurable sensations, whether of eating, drinking or sexual intercourse may result in structural defects and lessened resistance.

Methods of Cure.—To cure these various conditions. we use manipulations and surgical methods to correct structural defects in so far as it is possible. Resistance is thus increased. External stimuli are decreased so far as possible. Hygienic living and antiseptics aid in decreasing external stimuli. Water may be sterilized to eliminate any typhoid

bacilli, mosquitos killed to check malarial infection. These are recognized as methods of decreasing external stimuli.

Subluxations Are Mechanical and Chemical Stimuli. — Physiological writers mention four forms of stimuli of muscle and nerve, mechanical, chemical, thermal and electrical. The will may be named as a fifth form. Osteopathic medicine recognizes a sixth form which may be mechanical or chemical. It is the stimulation occasioned by the pressure of bone, muscle, or ligament upon nerve fibres or blood vessels. If the pressure is exerted directly upon a nerve bundle, the stimulation is mechanical; if it affects the metabolism of other tissues as a result of obstruction to circulation, the nerve endings are affected by chemical stimulation. This is an etiological factor not reckoned with in other schools of medicine. It is a distinctive feature of osteopathic medicine.

A twisted rib affords an example of this form of stimulation affecting nerve fibres in relation with it. The intercostal nerves supply motor fibres to the intercostal muscles, sensory and secretory fibres to the pleura and skin. The irritation resulting from a twisted rib pressing upon the intercostal nerve may result in intercostal neuralgia, pleurisy, or herpes, commonly called "shingles." If the irritation is removed, that is, the rib brought into proper relation with its fellows, the neuralgia, pleurisy or herpes is cured. They are the symptoms of a disturbed nerve. The stimulating impulses, originated by the pressure, cause changes in the activity of the tissues which are innervated by the irritated nerve.

CHAPTER II.

STRUCTURAL AND CONTRACTILE TISSUES.

The Cell.—Mechanical and vital phenomena are studied carefully by the osteopath. In order to know these phenomena and correctly interpret them he must first study the structure and functions of the cell.

Fig. 1.—Unicellular organisms possessing all the vegetative and vital attributes.

The attributes of this small element of the body are both vegetative and vital. Its vegetative attributes are three: metabolism, growth and reproduction. Its vital attributes are irritability and motion.

Following these natural divisions we find that the collections of cells to form tissues divide themselves into groups possessing definite qualities or attributes corresponding to one or the other of these vegetative or vital attributes of the original cell.

Fig. 2.—Photomicrograph of dividing cells. Cross section of young white fish, Coregonus. From slide prepared by Prof. B. M. Davis, Biologist in State Normal School, Los Angeles, Cal.

As the original cell divides and redivides we find certain groups of cells perpetuating, modifying and intensifying some special attribute of the parent cell. Naturally, as osteopaths, and following lines of tissue development, we are interested, first, in following the lines of development of structural tissues.

Structural Tissues.—Under this head we collect a considerable number of tissues whose function or special labor is to support the more active tissues. They give form and sta-

bility to the body. Bone, cartilage, ligament, tendon, fascia and connective tissue form this class.

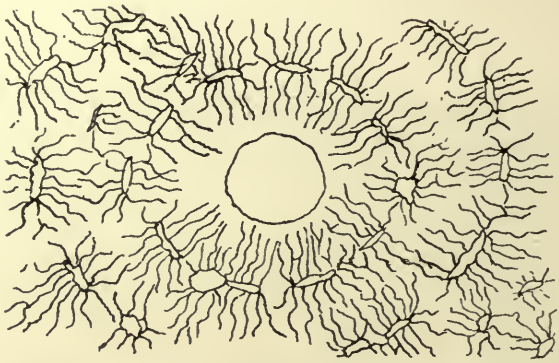


Fig. 3.—Cross section of bone. Camera lucida drawing by A. M. Hewitt, Instructor in the Physiology of the Eye, Pacific School of Osteopathy.

Contractile and Elastic Tissues.—Muscle and elastic ligaments constitute this class and serve to infuse action into the combination of structural tissues just named.

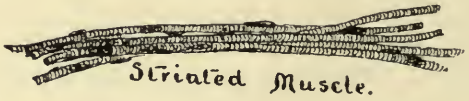


Fig. 4.—Muscle fibers, striated. Camera lucida drawing by J. E. Stuart, D. O.

Muscle unites two attributes of the original cell, i. e., it is a vegetative structural tissue and a vital motor tissue. This combination of attributes brings about many strange phenomena, as we shall see later.

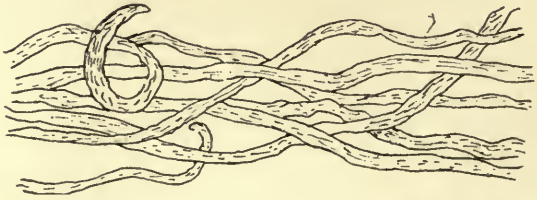


Fig. 5.—Yellow elastic tissue. Camera lucida drawing by A. M. Hewitt.

Yellow elastic tissue as we find it in the ligamentum nuchae and the ligamenta subflava must be considered as something more than structural tissue, hence we place it in this class.

Metabolic Tissues.—No sharp lines of demarcation are drawn here. We name those tissues whose cellular elements exercise the power of preparing food for other tissues or of excreting waste material; glandular tissue, mucous membrane, serous membrane and skin form this class.

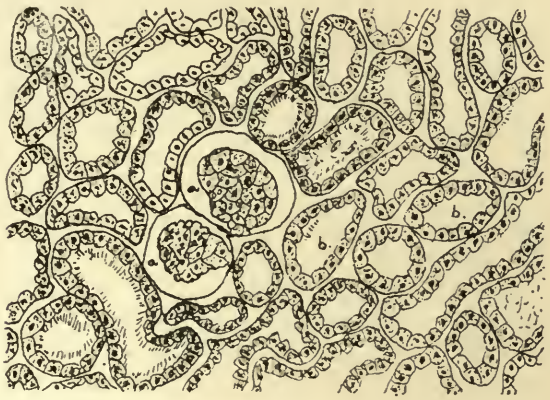


Fig. 6.—Kidney of a cat. X590. *a*, Glomeruli; *b*, Loops of Henle or collecting tubules. Drawn by A. M. Hewitt.

Fig. 7.—Medulated nerve fibers. Drawn by A. M. Hewitt

Irritable Tissues.—Muscle and nerve are the sole occupants of this class.

The tissues thus far mentioned constitute the form and solid substance of a human cadaver. If tissues could live independently of each other as amoeba live, then we might have

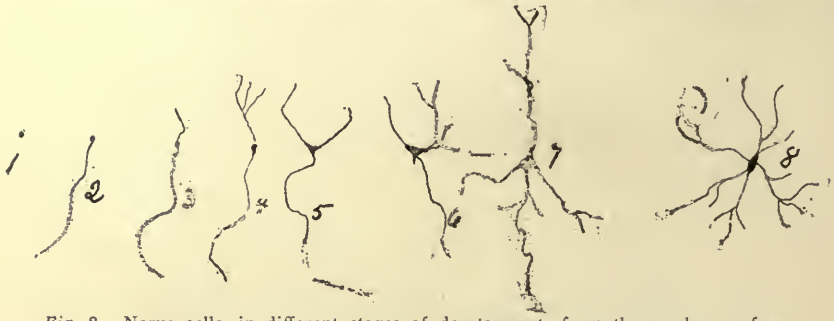


Fig. 8.—Nerve cells, in different stages of development, from the cerebrum of a fetal rabbit two or three days before birth. The cells from 1 to 7 are Golgi cells of the first type. No. 8 is a Glia cell from the same preparation. X150. Original drawing by C. H. Phinney, D. O.

life in this accumulation of cells, but since this is not possible we must add other tissues.

Circulatory Tissues.—These are blood and lymph. They are vital to all that have just been mentioned.

The blood and lymph are the media of exchange.

The nerves are the media of communication.

Blood and nerves complete the connection between all other tissues and fill us with wonder at the many phenomena caused by their activity. By considering blood as a tissue, we are not violating imagination nor becoming transcendentalists.

"Every tissue is composed of two parts; the cellular elements and the intercellular elements. Upon the first of these depends the vitality of the tissue, while its physical properties are determined by the character of the second. The physical condition of the intercellular substances includes a wide latitude, varying from that of fluid, as blood or lymph, through all degrees of density until by the additional impregnation of calcareous matters, the well-known hardness of bone or dentine is attained." (Piersol.)

Mechanical Principles.—Our next step is to consider some of the attributes of these several classes.

Osteopathy has been built up on the mechanical idea of the body rather than the vital; i. e., in the thought of the average

osteopath, form and structure, mechanical pressure, leverage, bony pressure, etc., have preceded the more complex vital phenomena which make up the picture of disease in older schools

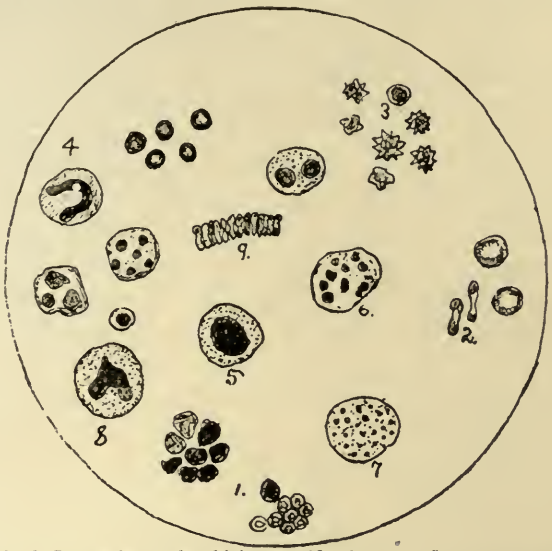


Fig. 9.—Blood Corpuscles under high magnification. 1, Groups of Red cells; 2, End view of Red cells; 3, Crenated corpuscles (Red); 4, Polymorphous Leucocyte; 5, Mononuclear Leucocyte; 6, Polynuclear Leucocyte; 7, Eosinophyle corpuscle; 8. Transitional Leucocyte; 9, Rouleau of Red corpuscles. Drawn by A. M. Hewitt.

of medicine. Therefore, in order to follow the subject along the lines of its development, we will consider the structural tissues first.

Displacement by Violence—Passive.—Structural tissues may be displaced by violence. The human body receives a vast number of falls, slips, jars, etc., which are liable to destroy the delicate adjustment of its bony parts. The chief wonder is that we do not have more serious results in a larger number of cases.

Up to the time of the advent of osteopathy in the field of medicine this etiological factor in disease was not taught. Slight structural displacements can not be successfully noted unless the diagnostician has been carefully trained in anatomy. All the successes of the early osteopaths were achieved by hands trained to make use of anatomical therapeutics.

It is not enough that an osteopathic physician should be able to recognize improper positions of bony parts; his observation and his thought do not halt here, but follow the normal physiological action in the immediate and remote areas, then he realizes what pathological conditions may result from the physiological perversion.

Obstruction to Vital Forces.– Since structural tissues are surrounded by vital tissues, irritable and circulatory, we may state the next proposition as follows: *Displaced structural tissues make pressure on irritable and circulatory tissues.* This proposition, simplified, means *obstruction to vital forces.* When the displacement takes place far from the centers of vitality, that is, the spinal cord and brain, the resulting perversion of function is not very wide spread. For example, the displacement of a tarsal bone will not create the disturbance that would be found as the result of a vertebral or costal subluxation.

The result of the pressure is a change in the normal metabolism in the deranged area. If the media of communication and exchange are cut off by this pressure, then metabolism is bound to suffer in the injured area or by reflex nervous irritability, a changed metabolism is found in a distant area. This does not mean that only points distal to the seat of injury will be affected because their means of communication and exchange have been cut off, but that an area apparently having no direct connection with the injured part may show metabolic changes because its nerve supply is given off from the same central area, and, in want of a better word to express my meaning, acts in sympathy with the injured part.

Cartilage may become subluxated in some localities and be the disturbing factor. For example, in the knee or temporomaxillary articulations. Ligaments may be strained and the resulting thickening cause obscure pressure symptoms. This is especially true of spinal ligaments.

Primary and Secondary Lesions.—Bear in mind that thus far we have considered all of our disturbances to be the result of external violence, and are hence primary etiological factors of disease. No perfect cure can be expected unless

this primary disturbance is righted and obstruction to the vital forces removed. Early osteopathic literature noted especially these bony lesions and urged the osteopath to search diligently for them and remove them. The great value to humanity of this method is amply proven by a multitude of cases in every State. If all lesions were of this character and primary, there would be little need of my writing farther, but we are vital mechanisms, hence complexity of arrangement and reaction draw us on to interpret the phenomena met with in our practice. *A lesion, according to osteopathic thought, is used to designate any derangement of tissue.* When they are recognized or considered as primary lesions they are treated as the first cause, if they are recognized as resulting from other disturbances, then they are considered as secondary lesions, but this does not preclude the idea of treating them as primary and hence working a change in opposition to a vicious cycle of reflexes. A secondary lesion may be the result of a primary one and at the same time be the primary cause of another secondary lesion and so on from cause to effect and on again. Herein lies the opportunity of the osteopath to display his anatomical and physiological knowledge in following these reflexes by a process of exclusion until he finds the primary one. This process of exclusion often requires a considerable time.

Displacement by Muscular Contraction—Active.—Our next proposition in regard to structural tissues is as follows: *They may be deranged by excessive activity of contractile tissue, muscle.* This brings us to the consideration of a tissue which is both structural and vital, but since its form and attachments are merely for the purpose of allowing its vital qualities to affect other tissues, we are principally interested in its vital attributes.

Muscle contracts as the result of direct mechanical stimulation, such as a pinch or prick; or as a result of poisonous material in its blood supply; or as a result of irritation of its controlling nerve, direct or reflex; also in response to sudden temperature changes.

With these four means of stimulation and the fact that in

the normal body, the controlling nerve of a muscle can be stimulated by temperature, pressure or poisonous chemicals in its blood supply, the fact dawns upon us that since muscles attach to bones, ligaments, tendons and fascia, and are subject to all these forms of irritation, contraction cannot help causing a change in structural tissues, and a faulty alignment of structural tissues will be manifested to the osteopath's fingers as lesions, primary, perhaps, to the minds of many, but in reality secondary. Another form of displacement of structural tissues may be the result of secretory tissues, their excessive activity being the result of derangement of nerve and blood supply. The derangement may be the result of direct or reflex irritation to the controlling nerves.

Summary.—Thus we have noted three forms of displacement of structural tissues; the first purely the result of extrinsic forces, violence; the second and third resulting from vital activities. Whether the displacement be a primary or secondary cause it may occasion the following results: *The lesion is an obstruction to blood supply, which equals a changed metabolism in the immediate area, resulting in irritation to the nerves in the immediate area either as result of pressure or lack of proper food. This is followed by an altered blood supply in distant or reflex areas through action of vaso-motor nerves, causing changed metabolism in said distant or reflex area resulting in weakened tissue through failure of proper exchange of food and waste elements. This decreases resistance to bacteria, hence opens the way to specific infection.*

To picture these changes more vividly we will state them in relation to some specific disease, diphtheria for instance. The atlas may be subluxated as a result of violence, such as a hard fall or stepping off a curb without being conscious of its presence. The shock and consequent strain of the muscles causes contraction resulting in subluxation. Both the shock and the resulting subluxation affect circulation in the immediate area, thus changing the metabolism going on in the suboccipital triangles. From this troubled area impulses are carried to the superior cervical sympathetic gang-

lion in such numbers and force that the normal action of this ganglion, vaso-constriction, is impaired. The nasal, laryngeal and pharyngeal mucous membranes become congested, thus working a change in the metabolism of their cells which gradually decreases their normal resistance to bacteria. These weakened tissues which are exposed to the air are now in a condition to yield to an amount of infection far inferior in strength to what would be required to overcome normal resistance.

This is an illustration of the osteopath's method of reasoning carried through to the point of specific infection.

The same train of reflexes may be originated by cicatricial tissue in any locality where the wealth of nerve connections or capillary circulation is sufficient to manifest the irritation.

Contractile Tissue.—It has been noted that muscle is a structural tissue, but its vital attribute is of greater interest. The most distinctive thing about our bodies is their power to move spontaneously. We speak of being quiet, but are never so in life, we respond to every change about us, infinitesimal changes in the atmosphere, every change is an evidence of muscular action. One-half of our bodies in weight consists of muscular tissue and contains about one-quarter of the whole amount of blood. It is muscular tissue which propels the blood and generates heat, in fact all of our functions depend on the muscles.

Amoeboid Motion—Contraction.—Your studies in histology will teach you the minute formation of muscular tissue, hence we need not spend time on that division of our subject. We know that the primative cell possesses the power of moving, called amoeboid motion, that in the process of differentiation of tissues muscular tissue is the specialization of this attribute of the primitive cell. One form of epithelium, the ciliated, possesses power of motion in its cilia. Muscular tissue possesses the property of contraction, that is, the power to draw its extremities nearer each other. Owing to the various attachments of the muscles to the bones we enjoy the ability to make many motions.

Stimuli.—Through the exercise of our wills our mus-

cles contract, but muscular tissue will respond to other kinds of stimuli; for instance, if a muscle fiber is pinched it will contract, or if it is subjected to the action of a strong acid it will contract. Rapid temperature changes affect it also. We do not lose sight of the fact that in the normal human body, muscles are not directly exposed to the action of external stimuli such as have been mentioned but they do respond to these stimuli under normal conditions through the transference of the stimulation to them by nerves. When studying the phenomena of muscular activity in the living human body, we are compelled to constantly reckon with the nerves which control the muscles. We, as normal beings, act according to our will. In order to control our muscles there must be a connection between the brain and the muscles. The motor nerves carry our willed action to the muscles. If these nerves are cut we lose control of the muscles in which the cut nerves end, but the muscles have not lost the power to contract. Contraction is a property of the muscle, not of the nerve; the nerve conveys the normal stimulus which causes the muscle to contract. The sensory nerves which are in muscles and go to the central nervous system, convey to our brain cells a knowledge of how the muscles are responding to our orders.

The nerve cells in our spinal cord are able to control many motions which we are not conscious of, hence attitudes, and positions of the vertebrae are assumed without sensory nerves informing our consciousness. It is possible therefore that muscles governed by these spinal nerve cells may contract in response to mechanical, thermal and chemical stimuli without conscious sensation being registered on the sensorium of our brain.

Direct and Indirect Stimulation.—Two propositions will make our position clear. *First, Muscle will contract in response to direct mechanical, thermal, chemical and electrical stimuli. Second, Muscle will contract in response to indirect mechanical, thermal, chemical and electrical stimuli.* We have to deal almost exclusively with the indirect stimuli. It is not probable that muscles ever contract as a result of direct

stimulation while they are under nerve control. For them to be subject to direct stimulation would be disastrous to the nervous system. In the case of burrowing parasites, trichinae, for example, there may be direct stimulation. A contraction of a muscle independent of nerve control while such control exists, is not probable; that is while the muscle has all the nerve connections intact between itself and the simplest kind of a nerve center. This fact compels us to consider all contractions of muscles as resulting from irritation of nerves, not of muscles directly. Motor nerves may be directly stimulated by subluxated bones, cartilage or by swelling, thus causing the muscles which they innervate to contract. Muscular contractions in the immediate and distant areas is coincident with all subluxations. As a result of chemical and thermal stimuli sensory nerves will pass their impressions to the motor side of a reflex arc and thus cause muscular contraction.

Structural Tissues Affected by Muscular Contraction. A contracted muscle always exerts its influence on movable structures, bone, cartilage, tendon, fascia, skin; or where muscle forms one of the layers of a hollow organ or vessel contraction lessens the caliber. *Lessened size of blood vessels means lessened nourishment to the parts supplied by those vessels. Lessened caliber of bronchioles means lessened respiratory power, hence lessened oxygenation of the blood.* When a muscle contracts it compresses its blood capillaries and raises blood pressure. If all the muscles of the body contract, as in violent exercise, blood pressure is enormously increased and the heart is put to a severe test. The relative effects on the whole circulation, caused by the contraction of one group of muscles might be small and yet be very detrimental to local circulation in the contracted area. Alternate relaxation and contraction adds strength to a muscle, but continuous partial contraction, such as results from continued stimulation, not only results in destroying structural alignment but injures the muscle substance. If the effects were all local, little attention would be paid to them but they establish a chain of reflexes which manifest themselves endlessly.

Circulation of Blood in Muscle.—A comparison of the blood which enters a muscle with that which leaves it shows that, whereas the former is bright red, contains a relatively large amount of oxygen and small amount of carbonic acid gas, the latter is dark blue in color and its proportions of oxygen and carbonic acid gas are the reverse of the former and contains other ingredients the result of katabolism in the muscle and its food; the temperature is higher in the latter than in the former. When a muscle is contracted continuously it does not receive its full amount of blood and this causes lessened irritability of the muscle substance, the same is true if the quality of the blood supplied is poor or the muscle vein is obstructed so that the muscle cannot get rid of its waste products. Restoration of irritability may be secured by removing the above causes.

Michael Foster has well stated the importance of the muscular tissue where he says that the whole of the rest of the body is engaged "(1) in so preparing the raw food, and so bringing it to the nervous and muscular tissues, that these may build it up into their own substance with the least trouble; and (2) in receiving the waste matters which arise in muscular and nervous tissues and preparing them for rapid and easy ejection from the body."

Effect of Contraction—Intrinsic.—The intrinsic effect of continuous muscular contraction is lessened activity of the muscle, hence lessened inter-change of food and waste products ending in decrease of muscle substance.

Extrinsic.—The extrinsic effect is principally noted in the amount of heat produced and the pernicious effect on circulation, both locally and systemically. Above all, to the osteopath the nerve reflexes which are the result of mechanical pressure resulting from contraction over a nerve trunk, or from a bone subluxated by over-contraction of an attached muscle, are most interesting.

Summary.—A muscular contraction may not cause widespread reflexes unless situated so as to mechanically irritate the nerve trunk. All muscular contractions along the spine are so situated that they may be considered irritating

lesions, whether they are primary or secondary needs to be determined by careful physical examination and history.

We pay little attention to the intrinsic effects of muscular contraction or to the chemical changes in the blood stream as a result of such contraction. The structural changes with the resulting nerve reflexes are what we are most interested in. If the contraction is secondary to a bony lesion, it is frequently treated indirectly through reducing the subluxation. If it appears to be primary, treatment may be applied to it directly or indirectly, i. e., by direct inhibitory pressure, stretching, inhibition of the motor nerve or thermally.

Our reasoning concerning these lesions again follows from perverted structure to perverted function and may be stated much as before: *The lesion is an obstruction to blood supply, which equals a changed metabolism in the immediate area, resulting in irritation to the nerves in the immediate area either as result of pressure or lack of proper food. This is followed by an altered blood supply in distant reflex areas through action of vaso motor nerves, causing changed metabolism in said distant or reflex areas, resulting in weakened tissue through lack of proper exchange of food and waste elements. This decreases resistance to bacteria, hence opens the way to specific infection.*

CHAPTER III.

IRRITABLE TISSUE.

A masterful knowledge of nerve tissue and its arrangement in the body to form the nervous system is an absolute prerequisite for success in osteopathic practice. Every vital phenomenon calls for interpretation by the skillful physician. Interpretation cannot be attempted without a definite knowledge of structure and function of that tissue which acts as a
3 medium of communication between all other elements of the body.

The name of our system, Osteopathy, calls attention primarily to osseous structure, but it is only in connection with

Fig. 10.—Pyramidal and Polymorphous cells from the cerebrum of a man 60 years old. X150. *a,* Polymorphous cells; *b,* Pyramidal cells.

its effects on the tissues of communication and exchange, vital phenomena, we are actually interested.

All physiological phenomena are characterized by the manifestation of attributes of nerve tissue, irritability, conductivity and trophicity; motion, sensation and nutrition are the vital phenomena whose perversion constitutes disease. Therefore whatever the pathological condition may be, we are called upon to note a change in some one or all of these attributes of nerve tissue.

We cannot proceed farther in a logical manner without frequent references to the special attributes of irritable tissue.

Fig. 11.—Photomicrograph of a Purkinje nerve cell in the cerebellum, human. Golgi preparation.

We will, therefore, devote this chapter to a special consideration of these attributes.

Fig. 12.—Photomicrograph of multipolar nerve cells in the anterior horns of the spinal cord.

Nerve Tissue—Scarcely any thought of muscle is ever complete without the nerve impulse which controls the

muscle is also considered. For convenience sake we may separate nerve and muscle when teaching their special attributes but for all practical purposes they are never separated.

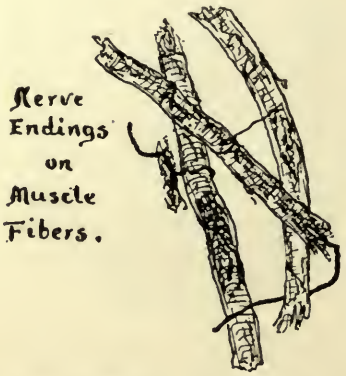


Fig. 13.—Drawn by J. E. Stuart, D. O.

The elucidation of our subject requires us to call your attention to some facts in physiology of nerve tissue which are essential to the foundation of our system of therapeutics. The nervous system consists of sending, conducting and receiving elements, that is, cells, fibers and end organs. It is the physiology of these elements, singly and en masse, which is of paramount importance in osteopathic diagnosis and therapeutics.

Irritability.—Muscle and nerve are both irritable, but we pay no attention to the irritability of muscle because under normal conditions we do not see any evidences of specific muscular irritability. We view muscular irritability as the result of nerve irritability. Therefore nerve tissue is the chief irritable tissue. Irritability is an attribute of cell protoplasm whereby chemical and physical phenomena are enacted in response to irritants. Irritants may be mechanical, chemical, thermal and electrical. Practically all that physiologists know of the reactions of nerve tissue to irritants has been derived through experimentation by means of the electrical current. Osteopathists are bringing to light many facts con-

cerning mechanical stimulation. Hydrotherapists have demonstrated the utility of thermal stimuli. Drug therapy makes use of the chemical form of stimulation.

Conductivity.—Nerve tissue is not only irritable but possesses the ability to transmit its irritability to other tissues and cause certain activities to be initiated there. Conductivity, the second vital attribute of nerve tissue, is the power to carry impulses from the point of irritation to other points in the nervous system. Irritability would be of small moment if conductivity were not present to transmit the message to the center and arouse response.

The nerve cell and its axis-cylinder are a continuous mass of protoplasm and as long as the continuity is maintained conductivity will be maintained.

Trophicity.—The third attribute of nerve tissue, trophicity, is very imperfectly understood. We do not use this term here to represent so much the nutritional influences of the cell-body over its axis-cylinder as the influence-exerted by nerve tissue over other body tissues, causing them to grow and prosper. This nutritional influence over other tissues is an attribute which we are compelled to note quite frequently in practice. There are individuals in whom motion and sensation are normal but nutrition fails, hence we note that in some cases mechanical lesions may cause only a slight change in the nerve tissue upon which it infringes, and this change is manifested by variation in nutrition of the part controlled by the irritated nerve. It is probably this attribute of nerve tissue which is perverted or lost when the tissues refuse to take up certain chemical elements which are ordinarily normal to them; for example, iron.

In osteopathic practice we consider nutritional disorders as being the result of perverted trophic influence of nerves. Of course in cases where it is known that the ingested food does not contain the required element or elements we must regulate the diet. But there are many cases where all conditions appear normal except that the tissues do not take up nourishment as they should. In these cases we search for lesions in the same way we would if motion or sensation

showed perversion or loss. This phase of our subject can best be considered at another time.

Unity of the Nervous System.—The unity of the nervous system is a physiological fact, and this brings deep and superficial areas in close relation. Every portion of the body is able through the medium of the nervous system to work in harmony with every other part.

Physiologists divide the nervous system into central and peripheral portions, but for practical purposes this division is of little use to us when attempting to make use of the irritability and conductivity of the nervous system for therapeutic purposes.

Since all portions of the nervous system are connected there must be some place where impressions made upon terminal nerve filaments may be assembled, co-ordinated and responded to harmoniously. Wherever large numbers of nerve cells are assembled we expect to find such duties performed.

Mechanical Irritation.—We have noted in the previous lecture that mechanical pressure made upon nerve fibers by subluxated bone or cartilage, contracted muscle or thickened ligament will set up changes in the protoplasm of nerve tissue. "Mechanical applications to nerve and muscle first increase and later lessen and destroy the irritability. Thus pressure gradually applied first increases and later reduces the power to respond to irritants." (Lombard, in American Text-Book of Physiology.) These structural displacements in the human body act as mechanical irritants to nerve tissue changing the chemical and physical condition of the protoplasm and thus altering its irritability, either plus or minus according to the intensity of the stimulation. The displaced structures may have other detrimental influences on nerve tissue, for instance the pressure brought to bear on the nourishing liquids surrounding the nerve, i. e. the blood and lymph, may cause sufficient chemical change in these liquids to materially affect irritability of the protoplasm of the nerves which they are expected to nourish.

Conductivity is not destroyed by these slight mechanical pressures. If the protoplasm of the cell and axis-cylinder

were unable to conduct impulses and project them in such manner as to reach other cell bodies of the nervous system our work would be very limited. Conductivity depends on the continuity of protoplasm. The mechanical irritations we deal with in osteopathic practice seldom destroy conductivity. If they did do so, they would cease to be irritants the moment conductivity was lost. Other irritants may act for a time on the severed portions of protoplasm but the original lesion would have destroyed the continuity of the protoplasm.

Double Conduction.—Double conduction is another physiological fact which explains to some extent the results observed in osteopathic practice when pressure is made over nerve bundles; but the complexity of fibers in the nerve bundle makes it impossible to say positively whether the central and peripheral phenomena are the results of double conduction or the presence of afferent and efferent fibers. Since we know that nerve bundles are made up of both afferent and efferent fibers there is no particular need for us to explain results by double conduction.

Nerve Bundles.—We have been dealing thus far with irritability and conductivity as attributes of nerve tissue. In a general way we have viewed the results of mechanical pressure on a solitary nerve fiber, not caring whether it is afferent or efferent or what its function. The next step is the consideration of nerve bundles. The fibers composing a nerve bundle may be efferent or afferent so far as direction of impulse is concerned. Efferent fibers may be further differentiated by the names, motor, vaso-motor, secretory according to the structures in which they end. Afferent fibers are usually termed sensory to denote their function of carrying impulses to the central nervous system. Nerve trunks contain all of these various fibers, therefore, pressure will irritate all of the fibers and conductivity of individual fibers will transmit the impulses in the direction of the normal nerve impulse, thus causing contraction in the voluntary or involuntary muscles or activity of secretory tissues; sensory impulses will be transmitted to the central nervous system and will purport to come from the terminal distribution of the sensory

nerve. If the afferent impulse is such an one as will reach the patient's consciousness, we find that the central cells are misled as to the location of the stimulus and hence manifest a response in the supposed area. It is not necessary for the patient to be conscious of any irritation in order to bring about this result.

The Central Nervous System.—The organization of the nerve bundle complicates our ideas of irritability and conductivity in the protoplasm of the cell and axis-cylinder of a nervous unit. Complexity of action and reaction increases as we near the central nervous system. We have considered that all impulses generated in the protoplasm of a nerve cell and axis-cylinder have been transmitted to all parts of that unit of nerve tissue, but has not in any way influenced any other unit. We have not considered the relations of cell bodies in the central system. It is sufficient for our present purpose to note that the afferent fibers enter the spinal cord as the posterior roots and that their cells are in the ganglia of these posterior roots.

The efferent fibers leave the cord as its anterior roots and their cell bodies are located in the anterior cornua of the gray matter of the cord. Upon careful study of the spinal cord there are found other cells and axis-cylinders which do not leave the cord but serve to connect the afferent and efferent elements and distribute impulses within the cord. These latter are found in enormous numbers in all portions of the central nervous system.

Segmentation.—The first fact of great interest to us osteopathically, is the segmentation of the spinal cord. This is only relative in character, but yet is apparent not only histologically, but pathologically. We note that according to distribution of afferent fibers in the spinal cord impulses are diffused both above and below the point of entrance. The cell bodies of the anterior roots are also somewhat diffused, but in practice we note that afferent and efferent impulses seem to be correlated within comparatively narrow limits in the spinal cord. How the impulses set up in the protoplasm of an afferent fiber are transmitted from it to the protoplasm of other cells

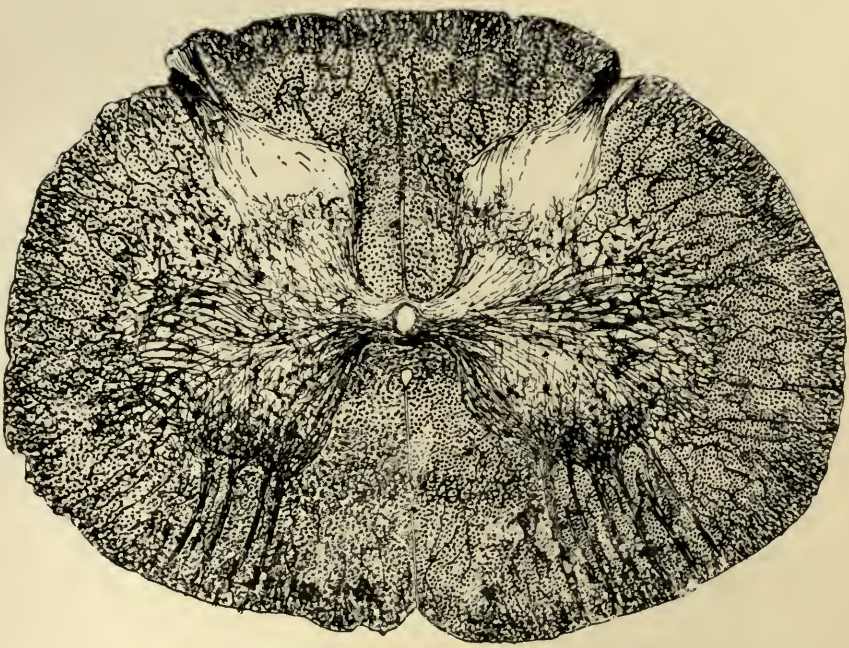


Fig. 14.—Camera lucida drawing of a golgi preparation, made by J. E. Stuart, D. O.

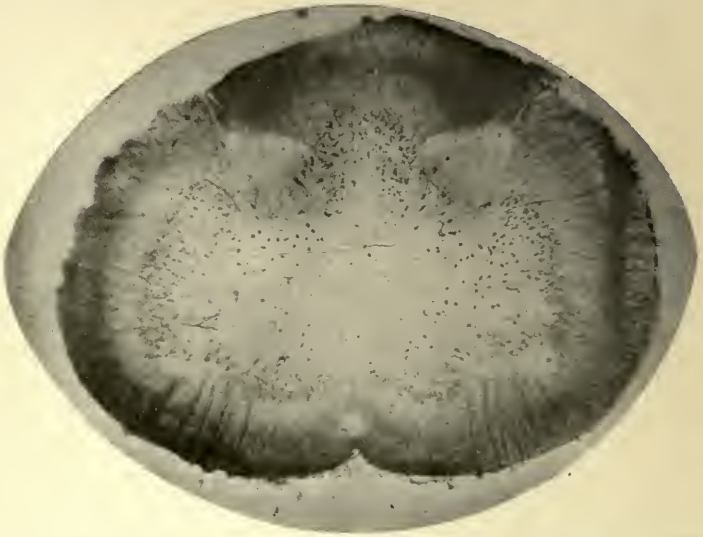
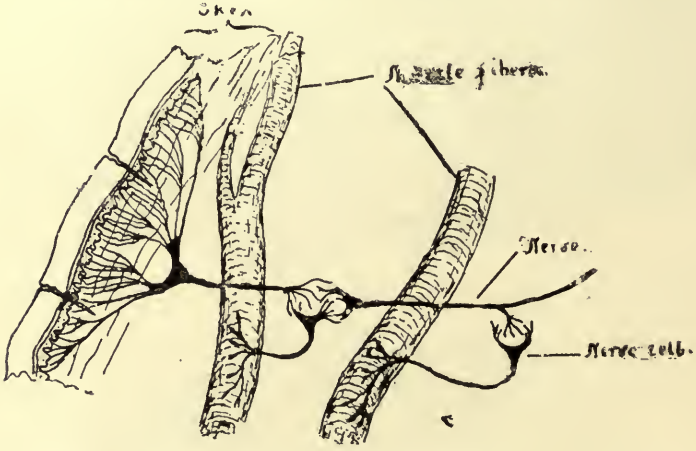


Fig. 15.—Photomicrograph of a cross-section of the spinal cord. Golgi preparation. Photographed by J. O. Hunt, D. O.

located in the spinal cord and thence transmitted to the protoplasm of efferent cells is not known, nor is it necessary for us to thoroughly understand the method in this instance so long as we recognize the results. Our specific knowledge must comprehend the exact point of entrance to and exit from the spinal cord of each nerve bundle and the peripheral distribution of the same. Having a knowledge of the structure, the function comes naturally as a result.

Segmentation refers to structure, and thus the next point, reflex action, which is physiological, is a logical sequence.

Reflex Action.—The central nervous system is con-



Some By-paths of Nerves.
Concerned in the Simplest
Reflex Actions.

Fig. 16.—Drawn by J. E. Stuart, D. O.

stantly receiving impulses from afferent fibers and co-ordinating them. We are almost entirely dependent on reflex action for the effects we secure on deep tissues. Our manipulations affect sensory nerves in skin, muscle and synovial membrane. These impulses are carried to the central nervous system and transformed into efferent impulses.

During life there is no period when the body is not de-

pendent on external stimuli. These ordinary mechanical and thermal stimuli keep a constant stream of impulses entering the central system to be translated into stimuli of muscle and gland. This ceaseless play of reflexes may vary in intensity, but so long as life lasts they are demonstrable. We expect the reflex to be initiated by the sensory side of the reflex arc, therefore the intensity of muscular contraction and glandular secretion is governed by the intensity of the initiatory impulse. This is certainly the case under normal conditions, but in the case of a subluxation, muscular contraction and secretory activity in the area of distribution of an irritated nerve trunk may be increased primarily, i. e., without the initiatory impulse being originated in a sensory nerve. The pressure on the efferent fibers to muscle and gland stimulates them without the intervention of the central nervous system. Our methods of diagnosis take into consideration both the mechanical lesions which cause direct stimulation of a nerve trunk, and those pathological conditions which are the result of intensified normal stimuli.

Practical Application.—*The segmental structure of the cord and the reflex action manifested therein show that on the whole, a definite muscle group and a definite cutaneous area are innervated from a limited portion of the central system. Therefore we may count on the stimuli originated in the cutaneous area being reflexed to the definite muscular area.*

An example in practice is as follows: patient's head is drawn slightly to the left side. Complains of pain shooting to the left shoulder and over the left clavicle whenever movement is attempted. History of exposure to draught of cold air. Physical examination discloses contraction of left trapezius, levator anguli scapulae and scaleni. Pressure upon these muscles causes pain. When instructed to take a full inspiration, patient says he can not on account of pain which is sharp and darting in character and radiates over the infraclavicular portion of the left chest. When we consider the muscles involved and the area of painful sensations our attention is immediately called to a definite segment of the cord, in this case the point of origin of the third and fourth cervical nerves.

The cold air striking the skin, intensified the normal stimuli, and the efferent impulses from that segment of the cord were intensified as the direct result of the cutaneous irritation. The point of irritation, the cutaneous area, governed the location of the reflex. So long as the original stimulus was only moderately intensified all the reflexes emanate from one segment of the cord, but if they had been more intense or continued longer, we might have found a greater area reflexly affected. The stimuli which would have reached the cord would have been more widely diffused above and below the point of entrance.

Since we know that the highly organized spinal cord of man is not to be compared with the same structure in lower forms of animal life, and that segmentation in it is illy defined, the practical question arises as to how much dependence we can put upon reflexes in the human nervous system. Will the reflexes guide us to definite segments of the spinal cord? Experience teaches us that a thorough knowledge of the distribution of afferent and efferent nerves in man will interpret reflexes with sufficient exactness and invariably lead the investigator to a spinal segment which is itself affected or is coordinating impulses from a known sensory area.

Efferent Fibers.—When we follow the efferent impulses to their points of distribution our work is greatly complicated. To reason from contracted voluntary muscle to cutaneous sensory area is a comparatively simple procedure; but to start with the sensory impulse and trace it through the central system, and thence along efferent pathways, to estimate its final effects as mechanical work done by muscle and gland in many combinations, requires a considerable knowledge of structure and function of all parts of the human system.

Many of the efferent fibers of the cerebro-spinal system take their course through the sympathetic ganglia and are distributed in that system to plain muscle and secretory cells of the body. It has been ascertained by various careful observers that these efferent fibers, after entering the sympathetic system, either end in the ganglia nearest their point of

emergence from the cord or pass up or down to ganglia above or below the one originally entered. Some fibers pass through these ganglia and end in the more peripherally placed plexuses.

Sympathetic Ganglia.—Wherever nerve cells are accumulated a certain amount of independent action is probably carried on. Terminal filaments of efferent fibers in sympathetic spinal ganglia are in relation with a large number of cells and the number of fibers leaving the ganglion is greater than those entering. Therefore diffusion of impulses from these ganglia must be very great. The accumulation of sensory impulses in these ganglia may be equally as great. Each ganglion must have a dominant influence over a certain visceral area, and this influence is subsidiary to the control exercised by the segment of spinal cord to and from which the larger number of its fibers proceed.

Diagnosis—Objective Symptoms.—Osteopaths have in great measure discarded subjective symptoms, believing that they are of very doubtful value in the large proportion of patients. Having discarded subjective symptoms, they have developed a method which gives equal or better results. It has three phases, two of which are structural and one which is partially subjective. First in order comes, *skeletal alignment;* second, *muscular tone;* third, *condition of reflexes.* These three divisions all come under the general head of palpation.

As an illustration of the value of objective in preference to subjective symptoms, the following case is of considerable value. The gentleman whose physical condition is practically illustrated in Figs. 17 and 18 was examined in the clinic of the Pacific School of Osteopathy. He had been operated on surgically for a peculiar enlargement just above and external to the right knee. The line of the incision is shown in Fig. 17. He stated that he had suffered pain at this point during more than a year, and his physician had decided that there was a tuberculous condition of the bone. The operation did not confirm this diagnosis. No unhealthy tissue was found.

Fig. 17.—Photograph of a case illustrating atrophy of the muscles of the right leg due to faulty trophic influence of the nerve cells in the spinal cord. The scar just above the right patella is superficial to a hypertrophic condition of the bone.

We noted his peculiar handling of the leg when walking, compared both limbs from toe to hip and discovered a marked difference in size, as is indicated in the photograph. By following the course of the nerves to the spinal column, we discovered that the muscles on the right side of the spine were atrophied in proportion to those of the extremity. Fig. 18 shows the fact that the atrophied condition extends into the interscapular region, and the spinal column is bent.

The patellar tendon reflex was lost on the right side, but present on the left. The right leg was ataxic, but the left leg was normal, thus presenting what might be called a unilateral locomotor ataxia. If this man's surgeon had taken the care to examine him from an objective structural standpoint rather than to depend on the subjective symptoms, it is highly probable that no operation would have been performed. Our examination demonstrated that this man's structural condition was at fault, and that the trophic influence of a part of his nervous system was being gradually lost. Both the motor and sensory nerves were acting feebly.

It might be asked, "How could one secure a spinal reflex from the stomach?" In what way would the finding of such a reflex surpass ordinary methods of examination?

The neurologist, when making examination of a patient suffering with some faulty condition of the sensory or motor portion of the nervous system, must possess a definite knowledge of the origin, course and distribution of nerve trunks in order to locate accurately the position of the lesion. The osteopath pursues the same method of examination, but follows it farther. His investigation takes into consideration the dispersion of efferent fibers in the sympathetic system and the sensory impulses received from the spinal cord from that system.

Edinger quotes Exner as follows: "One must not suppose that all the impulses reaching the spinal cord by the sensory roots are identical with what is ordinarily called 'sensation.' In order that an impression be perceived, it is not sufficient that it be conducted to the spinal cord, but it must be farther carried up, from the place where the peripheral

Fig. 18.—General view of case illustrated in the preceding figure. The spinal curvature is clearly indicated. Patellar tendon reflex absent on right side but present on the left.

part ends, to the cerebral cortex. There is, however, no doubt at all that all these higher connections are few in number, and that contrasted with the multitude of fibers in the posterior roots, the number of such cranial connections is quite small. This alone makes the conclusion possible that there are, indeed, many sensory impressions which arrive at the spinal cord, but that we are aware of but few of them at the time. All the viscera of the body, as the staining method has distinctly shown, are traversed by an altogether unexpectedly large number of nerves, and their arrangement and course, their relations to blood vessels and glands, and to muscle fibers, bones, and enamel makes it more than probable that there is, in this connection, a large system which serves essentially to regulate impressions and reflex action." Anatomy of the Central Nervous System of Man and of Vertebrates in General.—Edinger.

Co-ordination of Sensations.—It is the reflexes mentioned in this quotation in which we are interested. Sensation and perception are dissimilar. Sensations from the viscera are co-ordinated in fairly well-marked areas of the spinal cord, and when these sensory impressions are intense the efferent fibers of the spinal cord manifest the condition existing in a visceral area by causing an abnormal condition of muscular tone in the intrinsic muscles of the back. This contractured condition of the muscles is not the only evidence of the visceral reflex. Pressure on the contracted muscle causes pain. The intensity of the aesthesia is usually in proportion to the visceral irritation. Even though the patient does not say in so many words that there is pain on slight pressure, the examiner, if his palpation is good, can detect the reflex in the action of the muscle.

Example.—A patient comes to an osteopath desiring to be examined. He does not vouchsafe any information as to his condition, merely saying, "I want you to examine me and find out what is the matter with me." This is a challenge to the skill of the examiner and calls for something besides a long-distance catechising as to subjective feelings. The osteopath proceeds with absolute precision to determine

the condition of his patient's structural formation. (1) Skeletal alignment, (2) muscular tone, and (3) segmental spinal reflex. Each yields valuable information. The examiner's fingers may develop a reflex around the sixth dorsal spine. This is noted as a reflex from the gastric area. Testing the segments above and below this will show how great a section of the cord is irritated and will be an indication of the extent of the internal irritation, i. e., whether other portions of the digestive tract are affected. The reflex might extend as far as the fourth dorsal and still indicate the gastric area. Finding the reflex at the sixth dorsal spine has directed the attention of the examiner to the gastric area and has located a point from which further examination is to proceed. Percussion over the stomach would reveal other facts, and then the examination would be pursued along general lines of physical diagnosis to determine the character of the gastric disorder.

The moment the examiner centers his examination on the stomach, the confidence of the patient is assured. Is not this confidence greatly to be desired in every case? Is it not a force which compels the patient to follow the directions of his physician in matters of diet and hygiene?

In this example we have illustrated the attributes of nerve tissue, (1) irritability, (2) conductivity. Other conditions which make this illustration possible are (1) muscular contraction in response to nerve stimulation, (2) segmentation of the spinal cord, (3) reflex action.

We have added nothing new to the world's knowledge of nerve tissue, but we have applied general knowledge of this tissue to specific uses. We have taken the results of laboratory experiments and made them practical methods in the detection and alleviation of disease. It appears to us that sufficient research work has been done on the nervous system by medical men and sufficient general conclusions drawn from their investigations to justify all branches of the profession in making more extensive use of such data. The correlation of laboratory data with the results of clinical experience make the foundation of osteopathic diagnosis at the present time. By this bold application of knowledge, which

to the medical profession at large has been regarded as speculative and at least impracticable, osteopathy has gained an impregnable position in the healing arts.

Laboratories make scientists, not physicians; hence physicians have not always grasped the full significance of the scientific discoveries in physiology and applied them to therapeutics.

Whatever osteopathy may at present possess or gain in the future, is due solely to a close adherence to the facts of anatomy and physiology; and the application of these fundamental facts to scientific therapeutics.

CHAPTER IV.

CIRCULATORY TISSUE.

From the histological standpoint, blood conforms to the general definition of a tissue, being composed of a cellular and intercellular substance. The intercellular substance being liquid, differentiates it greatly from other tissues. It contains cellular elements which differ from each other in form and function. Then, too, it is a moving tissue enclosed in a system of closed tubes.

Functions.—The blood performs many functions. These may be stated in general terms as follows:

1. To convey nutrition to all other tissues.
2. To remove waste products from the tissues.
3. To convey oxygen for tissue respiration.
4. To distribute heat.
5. To repel invasion of bacteria.

Lymph.—Lymph is another liquid tissue, less rich in corpuscular elements, but greater in total bulk than the blood. The lymph comes in direct contact with the elements of the

tissues. Stewart states the relationship tersely where he says, "The blood feeds the lymph and the lymph feeds the cell."

Since we think of individual tissues as possessing some one well developed attribute or function, it is well to call blood and its congener, lymph, the media of exchange. This expression covers at least four of the functions previously mentioned.

With this comprehensive but short statement of the relation of these liquid tissues to the structural, contractile, irritable and secretory tissues, it seems hardly necessary to discuss so self-evident a proposition as that *health primarily depends on a perfect circulation.* It is not even necessary to add to this the fact that the blood should be pure, because under ordinary circumstances if the blood circulates properly it will become purified.

All schools of medicine have a therapeutic principle around which their practice is built. From its earliest inception the osteopathic idea has been that a perfect circulation is the foundation for perfect health.

Blood.—We will attempt to outline the general properties of the blood, and thus state the basic facts of the chemistry, histology and physiology of this tissue, which plays such an important part in osteopathic therapeutics.

Its color in the arteries is bright red, and in the veins is bluish purple. The difference in color is due to the relative amount of oxygen and carbon dioxide present in each. Arterial blood has more oxygen and less carbon dioxide, more extractives, salts and sugar, and less urea than venous blood. Arterial blood is usually warmer than venous. It is changed to a darker color when respiration is imperfect, or when the individual is subjected to a higher temperature. Venous blood becomes brighter when the individual is made to breathe pure oxygen. It is also brighter in the veins which drain an actively secreting gland or resting muscle. The temperature varies according to the location, that in the hepatic vein being the warmest. The blood in the visceral is warmer than that in the cutaneous vessels.

The proportion of blood to body weight is about one-

twelfth of the whole, i. e., twelve pounds of blood in a body weighing 150 pounds. This amount of blood is distributed approximately as follows: One-fourth to the heart, lungs and great blood-vessels; one-fourth to the liver; one-fourth to the resting muscles; one-fourth to the remaining organs." There is not blood enough in the body to maintain all of its activities at the maximum at the same time. Therefore it is difficult to do the best physical or mental labor just after digestion has begun. The splanchnic blood vessels are capable of containing so large a proportion of the whole amount of blood that death may result from lack of sufficient blood returning to the heart to cause it to beat.

Blood Corpuscles, Red.—The physical constituents of the blood are the red and white corpuscles and platelets.

The red blood corpuscles are the oxygen carriers. It is estimated that the combined surface of the corpuscles contained in five litres of blood would be 2,816 square meters, i. e., over one-half acre. These cells retain a special form but possess sufficient elasticity to allow them to pass through capillaries of a diameter less than their own, and then assume their normal contour. They are quickly changed in appearance by a change in the specific gravity of their surrounding media. As before stated, the red corpuscles are the oxygen carriers. Their function depends on the presence of a substance called haemoglobin, which unites readily with oxygen to form oxyhaemoglobin. Haemoglobin is a very complex substance, containing carbon, nitrogen, sulphur, iron and oxygen.

It is commonly estimated that one cubic millimeter contains 5,000,000 red corpuscles. This number varies according to age, sex, nutrition, and altitude.

Investigations seem to prove that these cells are derived from the red marrow of bone and end their life in the spleen and liver.

White Blood Corpuscles.—White blood corpuscles have been known since 1770. They are far less numerous than the red corpuscles, colorless, and some of them possess amoeboid motion. There are several varieties, grouped ac-

cording to staining reaction or microscopic structure. Not all possess amoeboid motion. Probably seventy per cent have well defined power of movement.

"It is indeed a question if the different forms of leucocytes are distinctive histological elements having independent origins and functions, or whether they do not, after all, represent different stages in the development of a single cell, the lymphocytes representing an early, and the polynucleated leucocytes the last stages."

The leucocytes are present in the blood in proportion to the red blood corpuscles about one to five hundred. Their number increases "after digestion, hemorrhages, pregnancy, in diseases in which suppuration occurs, and in leucocythaemia." Fasting decreases their number.

"Leucocytes are more numerous in the capillaries and veins of the spleen, liver, glands and intestinal mucosa than in the corresponding vessels of the skin, muscles, and general cellular tissues."

The functions of these cells are many and varied. A white blood corpuscle may be considered as an unmodified cell retaining all attributes of the amoeba. Because of its independent movement, observers have called it a "wandering cell." They have the power to enter all tissues, passing from the plasma through the vessel-wall into the perivascular tissue. They re-enter the blood current with the lymph. This process of migrating is continually going on, but is greatly increased by pathological conditions. This action of the white cells is known as "diapedesis."

After leaving the blood stream in response to some pathological condition of the tissues, they may either re-enter the circulation, be organized into repair tissue, or die and become pus cells.

Some of these cells have been observed to surround and dissolve foreign substances, and are hence called phagocytes. Not all leucocytes are phagocytes, nor is this function limited to wandering cells. Some endothelial cells also possess this function. Metschnikoff has stated a theory of immunity to various bacterial diseases based on this phagocytic function.

These leucocytes or their products are concerned in the coagulation of the blood.

The origin of the leucocytes is supposed to be the lymph glands, since more cells appear in the fluid leaving than in that entering the glands.

Little of a definite character is known of the blood platelets. Fibrin is an albuminous substance which appears when blood coagulates. It is concerned in the stopping of hemorrhages.

The scope of this chapter does not contemplate a close examination into all the constitutents of the blood, but we desire to impress upon our readers the universality of function possessed by the blood.

Chemical Constituents.—The chemical constituents of the plasma are very numerous, and it would require considerable space to even enumerate them. There are inorganic and organic substances, some of which act as food for the tissues, others being the result of katabolism.

Aside from the chemical constituents, there are many ferments. Besides the well known fibrin ferment, there are diastatic, glycolytic, lipolytic ferments. Serum also possesses a globucidal and bactericidal action.

From this suggestive review of definite constituents of the blood, it will be readily noted that our classification of the functions of the blood is not too broad.

Distribution of the Blood.—Granting that the blood possesses all these functions, the question still confronts us, How can we affect its distribution? This question leads us to a consideration of the physiological distribution of the blood. It is believed by the writer that nothing besides the use of water has so great an effect on the circulation of the blood as manipulation according to osteopathic methods. These methods do not depend on a mere physical assistance of the venous flow by means of centripetal stroking, such as is employed by a masseur. Effects on circulation are obtained in nearly all cases by knowing where definite nerves which control the action of the heart and blood vessels are placed and what their action in response to irritation may be. All

manipulations are given with a definite knowledge of the location of blood vessels and the nerve centers which control their variation in calibre. *The response secured is a new coordination of the whole circulation brought about under the control of the nerve centers.* Compression of the carotids by the fingers will lessen the amount of blood flowing to the brain, but such a compression has no effect after the fingers are removed. From the osteopathic standpoint this procedure would be considered useless. Physiological experiments have demonstrated that the blood vessels of the head and brain will contract in response to stimuli from definite areas; therefore, osteopaths treat these areas and thus secure a *readjustment of the entire circulation which is more lasting than can possibly be secured by definite compression.*

It has been stated that the blood is contained in a closed system of tubes. A short resumé of the most important points in the anatomy and physiology of the circulation may prepare us for a clearer insight of the modus operandi of osteopathic methods.

The Circulatory Apparatus.—The circulatory apparatus consists of the heart, arteries, capillaries, veins and lymphatics; some writers include the spleen.

Muscular tissue is found in the heart, small arteries and veins. The heart is practically all muscle, and its contractions are governed by two sets of nerve fibers from the cerebrospinal system, the first set is called accelerator; second, inhibitory.

Likewise, the small arteries and veins have two sets of fibres which increase and decrease the intensity of the contraction of their muscular fibres, and thus change the calibre of the vessels.

The capillaries are short, narrow tubes, having a thin wall composed of nucleated cells which possess the power of contraction. So far as known, the capillaries expand and contract in response to the degree of physical pressure exerted by the blood current coming from the arterioles. Thus the change in the calibre of the capillaries is passive. The lymphatics begin in small irregular spaces in the cellular tissue out-

side of the blood vessels. They are found in direct relation with the cells of perivascular tissues, thus bringing the lymph to each cell. These openings lead to small lymphatic vessels which convey the lymph to the lymphatic glands which are situated so as to filter out the impurities, after which it is emptied into the venous circulation by the lymphatic ducts. The lymphatic vessels possess power of contraction. The lymph equals about one-third of the body weight.

The blood is a passively moving tissue. It is kept in constant circulation within a closed system of tubes by a combination of forces. The propulsion of the blood is almost entirely accomplished by the contraction of the heart. This initial force is supplemented by the aspiration of the chest during respiration, and the contraction of the skeletal muscles of the entire body. It is a debatable question whether or not the muscular coat of the arterioles and venules assist in the direct propulsion of the blood passing through them.

It is the function of the heart to maintain a comparatively uniform tension of the blood in the large arteries. The arterioles and capillaries are concerned in maintaining resistance to the passage of the blood. The degree of resistance in the capillaries, in large measure, determines the amount of nourishment received by the tissues. The relation between capillary resistance to the passage of the blood and the metabolism carried on in perivascular tissues is a point of great importance. The current of blood ordinarily passes through the capillaries very slowly, at a rate of one inch in two minutes, and under low tension, thus giving ample opportunity for the escape of nourishing material for the surrounding tissues.

Tension in the arteries is maintained by three factors: 1. The initial force of the heart beat; 2. Friction in the vessels; 3. Elasticity of the vessel walls. The first and third of these factors are under nerve control which act according to a large number of stimuli.

The capillaries being passive in action, the tension of the blood stream in them is mainly dependent on the tension in the arterioles. It may be profitably noted that after the initial impulse is given to the blood stream by the heart, the distri-

bution of this blood depends solely on the arteries, arterioles and capillaries. This peripheral distributive mechanism is therefore responsible for the nutrition of the tissues, and its resistance offered to the passage of the blood, regulates the amount of force exerted by the heart.

Manipulatory treatments, according to the best authorities writing on massage and Swedisn movements, have for their object the acceleration of the blood flow on the venous side of the general circulation. Osteopathic manipulations are essentially directed to the active instead of the passive side of the circulation.

The osteopath makes use daily of the vaso-motor nerves in order to control the circulation of the blood in local areas; therefore, it is necessary to make a detailed study of this wonderful mechanism in order to achieve the best results in practice.

The more we know of structure and function, the more rational ought our methods of treatment to be, because we will then have no excuse for using methods which do not have a scientific basis to recommend them.

The Heart.—In order to affect the active side of the circulation our manipulations must affect the heart beat. There are two sets of nerve fibres arising in the cerebro-spinal system which exert a regulating influence on the beat of the heart. Heart muscle possesses an inherent power of rhythmical contraction as can be readily proven by removing the heart from the body and stimulating it mechanically. It will beat rhythmically for hours if the muscle be kept moist with a one per cent salt solution.

Contraction begins in the auricles and ends in the ventricles; hence, it is thought that the auricular rhythm is transmitted to the ventricle. Any influence which changes the auricular rhythm also changes the ventricular rhythm.

Regulation of Contraction.—Since the heart possesses inherent power of rhythmic contraction, the nervous system acts merely as a regulator of the rate of contraction. The two centers of cardiac control act in a manner to increase or decrease the rate. The speed of the blood current is depend-

ent on the rate and strength of the cardiac contractions. The pressure of the blood is dependent on the rate and strength of the cardiac contractions, together with the resistance offered by the arterioles and capillaries. Considering the arterioles and capillaries as possessing fixed diameters, an increase in the number and strength of the heart beats would increase the speed and pressure of the blood current. A lessened cardiac activity would have the opposite effect. The speed and pressure of the blood stream may vary within wide limits and still maintain a fair degree of health.

Co-ordinating Centers.—The nerve impulses reaching the heart are co-ordinated in two governing centers in the cerebro-spinal system. These centers are located in the bulb. The inhibitory center is connected with cells in the walls of the heart by fibres which form a part of the pneumogastric nerve. Section of the pneumogastric nerve removes the inhibitory influence over the heart's action. Stimulation of this nerve slows the heart. The relaxation period is lengthened which results in greater filling of the heart and the pressure in the veins is increased while arterial pressure decreases. These results have been noted by many physiologists.

The Pneumogastric Nerve.—The pneumogastric is one of the nerve trunks which can be reached by direct pressure made through the skin and muscles of the neck. Its inhibitory action can be aroused by pinching the sterno-cleido-mastoid muscle between the thumb and forefinger, taking care to work deeply under the internal margin of the muscle.

It is no uncommon phenomenon to have a patient faint as a result of this manipulation. Individuals differ greatly as to their response to this stimulation. The stimulation should be a gentle pressure of a constantly varying intensity.

A pulse tracing is appended, Fig. 19, which shows the results of stimulating the pneumogastric in the manner just described. The gentleman upon whom the experiment was made was in excellent health, and possessed a quiet, well-balanced temperament. The tracing shows that the number and force of the beats was lessened and arterial pressure decreased. This tracing is probably typical of the change, in a

well person, in response to stimulation of the pneumogastric. No sensation of faintness or other disagreeable feeling was noted.

The inhibitory action of the pneumogastric seems to be most active in individuals who suffer from some disorder of the digestive tract. In such patients the constant irritation of the sensory fibres of the pneumogastric, which arise in the mucosa of the digestive viscera, seems to increase the irritability of the whole nerve trunk to such a delicate point that the slightest stimulation made at any point along the

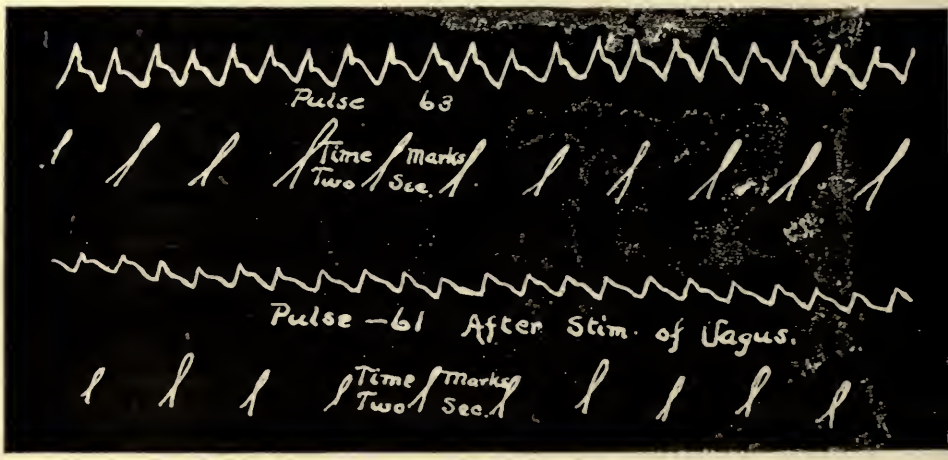


Fig. 19.—Stimulation of the pneumogastric by pinching the nerve trunk in the neck.

course of the nerve will excite its inhibitory action. Many osteopaths, just starting in practice, have had their self-possession severely tried by a patient fainting during manipulation of the neck. I have never heard of any fatal results from manipulation of the pneumogastric. Why stimulation of the pneumogastric should result in cardiac inhibition rather than in phenomena connected with its other branches seems incapable of explanation. Sometimes spasm of the laryngeal muscles will accompany cardiac inhibition.

The intensity of action of the pneumogastrics is so well known to experienced osteopaths that they are careful to test

its irritableness in cases before undertaking any extensive manipulations along its course.

The inhibitory center is continually active, and acts according to the blood pressure within the arteries. A rise in peripheral resistance causes a decrease in number and strength of the heart beats.

Accelerator Center.—The accelerator center is connected with the heart by fibres which descend in the cord to the upper portion of the dorsal region; here connection is made with the cells whose fibres pass to the sympathetic spinal ganglia, 1st, 2nd, and 3rd dorsal, and end there around other cells whose fibres convey their impulses to the heart.

The action of the accelerator center is not so readily demonstrated as is the case with the inhibitory center. It causes the heart to beat faster and stronger, thus bringing about a rise in arterial blood pressure and a fall in venous pressure. This center acts in response to lowered peripheral resistance. The products of metabolism brought about by physical exercise also excite it. Deep, steady pressure made on the muscles lying on each side of the 1st, 2nd and 3rd dorsal spines causes a decrease in the rapidity of the heart's action.

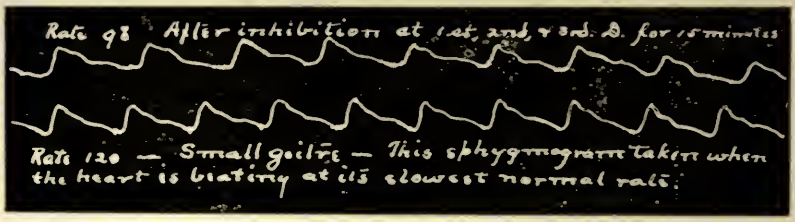

Rate 98 After inhibition at 1st, 2nd, & 3rd. D. for 15 minutes
Rate 120 — Small goitre — This sphygmogram taken when the heart is beating at its slowest normal rate.

Fig. 20.—Sphygmograms illustrating the effect of inhibition at the 1st, 2nd and 3rd dorsal.

Stimulation of the Heart.—A make and break pressure made at the edge of the sternum in the 1st and 2nd intercostal spaces will usually stimulate the heart. Sometimes the first effect is inhibition, but it quickly passes to stimulation. The manipulation made anteriorly increases the number and intensity of the stimuli reaching the segment of the cord from

which the accelerator nerves pass out. *All centers act according to the sum of the stimuli reaching them from all sources.*

Inhibition of the Heart.—In cases of rapid heart beat with high tension pulse the best effects are secured by digital pressure at 1st, 2nd and 3rd dorsal spines. The pneumogastrics have too many branches to important viscera and act frequently with unexpected intensity. The accelerators act more slowly with less intensity and the action is sustained longer, that is, as a result of manipulation.

Vaso-motor Control of the Coronary Arteries.—A further factor in relation to the regulation of the heart's action is the blood supply for the nourishment of the heart. All organs act with greater force when their blood supply is abundant. The heart beats stronger when its coronary arteries are dilated than when constricted, therefore the power of the heart depends on the vaso-motor control of its own arteries. The vaso-motor nerves to the coronary arteries leave the cerebro-spinal system between the 3rd and 5th dorsal spines. In cases of angina pectoris, this area will be sensitive. Steady pressure here will dilate the coronary arteries and ease the pain. A sharp stroke with the hypothenar eminence on the fourth dorsal spine will nearly always start an attack with such patients.

Angina Pectoris.—Physiologists name the pneumogastric nerve as the vaso-motor nerve to the coronary arteries. I mention the area, 3rd to 5th dorsal, as a vaso-motor center for the coronary arteries because clinical experience seems to demonstrate it. Other osteopaths have noted the frequency of lesions in this area in connection with heart difficulties. The lesions are contracted muscles, lateral subluxations of the vertebrae or in some instances subluxations of the fourth and fifth ribs. With any of these lesions there is intense sensitiveness.

Dr. George Keith, of Scotland, mentions digital pressure in the second left intercostal space as a means of inhibiting an attack of angina pectoris, and suggests the nerve connection of the pneumogastric as being the nerve path over which the inhibitory impulse travels.

Persons suffering with angina pectoris will press their hands, with all the force they possess, against the left chest. I have used heavy digital pressure on the left side of the fourth and fifth dorsal spines while the patient was in a paroxysm of pain. The pressure never failed to be grateful to the patient. A further experiment with this center was made by extending the patient in a recumbent position. While extension was maintained the angles of the ribs could be raised, the left arm could be extended over the head, a full inspiration could be taken, but as soon as the vertebrae were allowed to approximate as a result of cessation of extension, these things could not be done.

Heat, digital pressure, and counter irritation are capable of causing vaso-constrictor paralysis, i. e., vaso dilation, and hence increase the power of the heart in such cases.

Action of the Heart Centers.—The governing centers of the heart act principally according to the peripheral resistance maintained by the blood vessels. The heart possesses a nerve called the depressor nerve. Its endings are in the walls of the heart and are affected by the pressure of the blood within the heart. A rise in arterial pressure is followed by a rise in pressure within the heart. The depressor nerve notes this fact and carries an inhibitory impulse to the vaso-dilator center in the medulla, thus bringing about a fall in arterial pressure. In this way the heart is protected from over exertion as a result of too high pressure.

In cases having rapid, weak heart action, inhibit the accelerators to slow the heart, also inhibit in the area of vaso-motor control of the coronary arteries to increase the amount of blood for nourishment to the heart muscle, thus increasing the strength of the beat.

In cases of rapid, high tension pulse, inhibit the splanchnics and suboccipital fossae to lessen peripheral resistance, also inhibit the accelerators or stimulate the pneumogastrics.

Vaso-motor Nerves.—In 1840 Henle discovered and demonstrated the muscular coat of the arteries, and as a result of this step forward we have our present knowledge of the vaso-motor nerves. Associated with the demonstration of

these nerves, we have the names of Brown-Sequard, Bernard, Waller and Schiff.

It has been proven that two sets of fibres innervate the muscles of the arteries; a vaso-constrictor set, which causes a decrease in the calibre; and a vaso-dilator set which causes an increase in calibre. The constrictors were demonstrated first.

Fig. 21.—Drawn by J. E. Stuart, D. O.

Henle said "the movement of the blood depends on the heart, but its distribution depends on the vessels." We have followed the phenomena in connection with the first part of this quotation, hence it remains for us to study the part played by the vessels in the distribution of the blood.

In order to carry our thoughts along in a proper manner, we will commence at the center and work toward the periphery.

The chief vaso-motor center is in the medulla. Destruction of this center causes an immediate fall of blood pressure all over the body. Stimulation of this center causes a general rise of blood pressure.

There are subsidiary centers situated at various levels in the spinal cord.

After the spinal cord is severed, that portion which is no longer connected with the chief vaso-motor center will exercise a vaso-constrictor influence over the blood vessels in its area of normal control. "It is probable that they are normally subordinate to the bulbar nerve cells."

After all connection between the cerebro-spinal system and sympathetic spinal ganglia is cut off, the tone of the blood vessels is maintained, after a short interval, by the sympathetic ganglia.

By commencing at the center and destroying it, then the centers in the spinal cord assume control; destruction of these leaves the sympathetic spinal ganglia active; hence by this process of exclusion, we find that the true vaso-motor cells are sympathetic and lie in the spinal ganglia. From these cells in the spinal ganglia axis cylinder processes pass as gray fibres to blood vessels. These ganglia cells are controlled by fibres from the chief vaso-motor center in the medulla which end around the subsidiary cells in the spinal cord, the neuraxons of these latter terminating by filaments which surround the true vaso-motor cells in the sympathetic spinal ganglia.

Since gray rami-communicantes pass from the spinal sympathetic ganglia to the spinal nerves and are distributed with them to the skin and blood vessels, we can influence the distribution of the blood generally and locally by increasing or decreasing the number of sensory impulses, originating in the skin and muscle, which may reach the vaso-motor centers.

"The vaso-motor apparatus consists, then, of three classes of nerve cells. The cell bodies of the first class lie in sympathetic ganglia, their neuraxons passing directly to the smooth muscle in the walls of the vessels; the second are stimulated at different levels in the cerebro-spinal axis, their neuraxons passing hence to the sympathetic ganglia by way of spinal and cranial nerves; and the third are placed in the bulb and control the second through intraspinal and intracranial paths. The nerve cell of the first class lies wholly without the cerebro-spinal axis, the third wholly within it, while the second is partly within and partly without, and binds together the remaining two." Am. Text-book of Physiology.

Vaso-constriction.—The vaso-constrictor nerves which pass from the bulbar and spinal centers of control leave the cord as white rami-communicantes from the anterior roots of the second dorsal to the second lumbar nerves and enter the sympathetic ganglia to be distributed as has been described

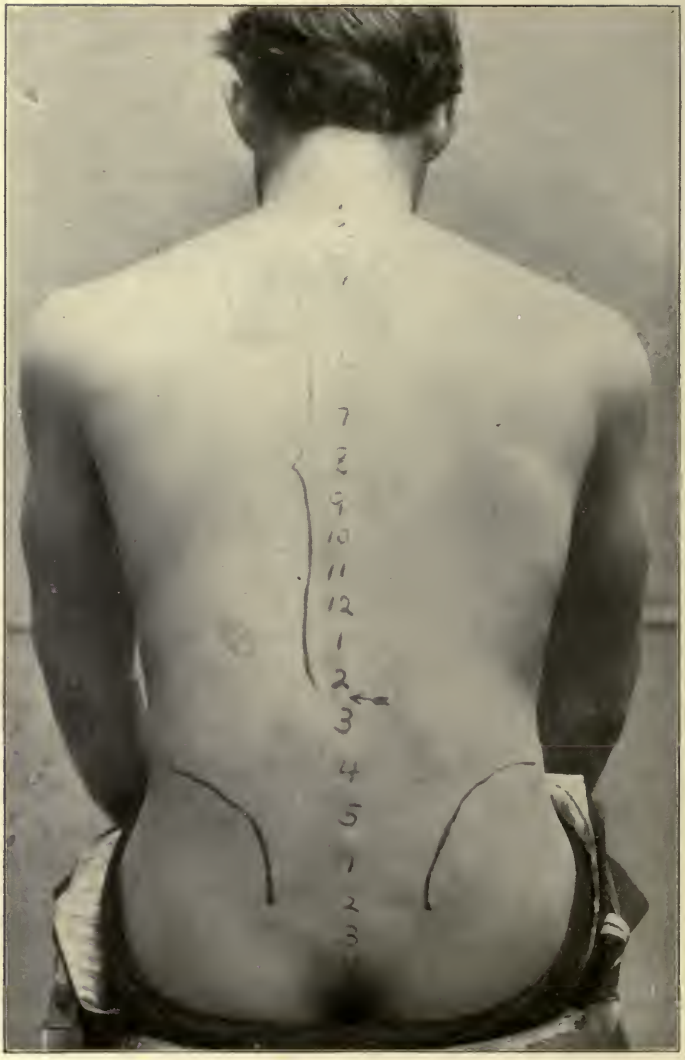


Fig. 22.—Vaso-constrictor area, 2nd Dorsal to 2nd Lumbar.

before. It is believed that all of these vaso-constrictor fibres end in the ganglia, thus exerting their influence on the true vaso-motor cells in the ganglia which, alone send fibres to the blood vessels. All these constrictor nerves are gray.

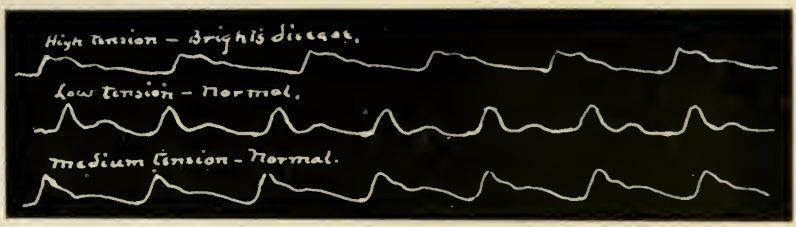


Fig. 23.—Arterial tension is manifested in a sphygmogram by the relative height of the aortic notch. The upper tracing shows the aortic notch on a straight line drawn from the top of one percussion wave to the bottom of the next. The middle tracing shows this notch very low.

Vaso-dilation.—The vaso-dilator fibers are not restricted to any one portion of the cord or brain, but pass out with both cranial and spinal nerves, and do not lose their sheaths until they reach their destination. They are best demonstrated in those regions of the cerebro-spinal system from which vaso-constrictors do not arise. The vaso-dilators from the head, face, salivary glands, etc., pass to their destination with the cranial nerves supplying these parts. They do not end in the sympathetics. They probably leave the cord in the anterior roots of the spinal nerves and pass to the periphery without interruption. The vaso-dilators, leaving the cord in the same region as the vaso-constrictors to be distributed to the visceral blood vessels probably pass out by the ventral roots and reach their destination without losing their sheaths in the sympathetic ganglia.

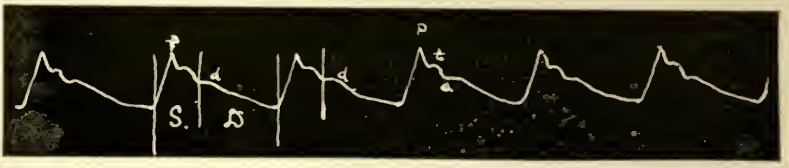


Fig. 24.—The significance of a sphygmogram. The space S is the period of ventricular systole when the aortic valves are open; the space D the period of ventricular diastole; *t* the tidal wave due to the ventricular systole; *p* the percussion wave due to instrumental defect; *a* is the aortic notch which marks the closure of the aortic valves; *d* the dicrotic wave.

No distinct centers for vaso-dilator fibres have been demonstrated. They probably arise from segments of the brain and spinal cord and their influence is carried along the paths of motor nerves and is exerted in a local area.

Summary.—1. The vaso-dilator nerves are cerebro-spinal; (a) and are not demedullated in the sympathetic ganglia. (b) They are distributed principally to the arteries of the muscles; (c) and leave the cerebro-spinal axis with the motor nerves from all portions. (d) Their influence is local.

2. The vaso-constrictors are essentially neuraxons of sympathetic cells in the spinal ganglia; (a) are gray fibers; (b) are distributed to viscera and cutaneous blood vessels;

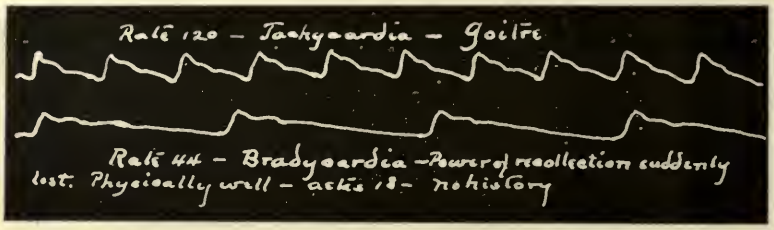

Rate 120 – Tachycardia – Goitre
Rate 44 – Bradycardia – Power of recollection suddenly
lost. Physically well – actis 18 – no history

Fig. 25.—Sphygmograms illustrating Tachycardia and Bradycardia. Upper tracing is from radial pulse of a woman exhibiting great nervousness, a small goitre but no exophthalmos. Lower tracing is from radial pulse of a young man whose power of recalling past events of his own life was suddenly lost. Result of mental shock.

(c) and are probably continuous in action to maintain the tone of the vascular system. (d) The vaso-motor cells in the sympathetic ganglia can act independently, (e) but are normally under the control of the cells in the spinal cord whose neuraxons end in the spinal ganglia. (f) These cells in the spinal cord are under the influence of neuraxons of cells in the medulla which constitute the chief vaso-motor center. (g) Therefore, the vaso-constrictor influence is both local and general. (h) The controlling fibres leave the cord in the ventral roots of the second dorsal to the second lumbar nerves only.

THE SENSORY NERVES.

We have now considered in detail only one side of the vaso-motor mechanism, the motor. We have yet to note the sensory side, that which calls forth the motor response. If there were no chief or spinal vaso-motor centers to transfer sensory impulses to the vaso-constrictor cells in the spinal ganglia, the blood vessels in the viscera and skin, could not

contract or relax according to the necessity for greater or less amounts of heat in the deep or superficial areas.

The vaso-motor centers in the brain and cord send out impulses in response to sensory stimulation; this sensory stimulation is usually of a thermal or mechanical character.

It is difficult to realize the extent of the distribution of sensory nerves. "They are located not only in those places usually known to be sensitive, but also in all other tissues and organs. Whether one examine the liver or the kidney, lung or the wall of a blood vessel, one always finds delicate nerve arborizations in unsuspected numbers. A large portion of them end probably in the peripherally placed end cells belonging to the reflex arc of the sympathetic; another portion may very probably be traced to the spinal ganglia, and even to the spinal cord itself, especially the investigations of the past two years, making use of the silver and methyl blue stains, have not only disclosed the wealth of nerves in the different organs, but have also shown that we have regarded the sensory innervation of the sensitive surfaces, as the skin, and the gustatory-mucous membrane as much less fully explained than they really are. One finds there numerous plexuses of nerve fibres beneath and between the epithelial cells, and they send one, often many fine fibrils to each cell." * * * * "In the liver, too, and the bladder, and many other places, one can find numerous examples of the abundant peripheral innervation. We have always given too great importance to the single end apparatus, overlooking the fact that really the major portion of the body tissues is supplied with nerves for every cell. One can hardly overestimate the wealth of nerve fibres in the end organs themselves, as the taste papillae and the tactile papillae. Good staining discloses with each of them plexuses of unexpected density of arborization."

"For what services may such an abundant sensory innervation be provided? It occurs immediately to one that there is a great number of reflexes, very necessary to the preservation of the individual, even though he be unaware of them. The regulation of the secretions, the blood supply to the skin in relation to the caloric body economy of the organism, the

adjustment to varying illumination, the tension of the muscles and tendons through the respective tendon reflexes, the different response by such varying tensions according to the intensity of the voluntary impulse, and many other phenomena could be cited. To all of them is necessary, besides the motor part of the reflex arc, a sensory part. Indeed, Exner, to whom we are indebted for indicating the importance of these short reflex arcs and the roles they play in the organism, has pointed out how, in general, for the production of any movement the sensory innervation must be intact."

"By 'sensory innervation,' however, one must not think only those processes are meant which enter into our consciousness, but rather all those by which from any place in the body impressions are conducted to the nearest ganglion, or to the central axis. Whether they be conducted farther still, or whether they be recognized by the individual as they occur does not affect their nature. Sensation and perception are not the same thing."—Anatomy of the Central Nervous System in Man and in Vertebrates in General.—Edinger.

Thus we find that there are abundant sensory nerves in superficial and deep tissue to receive the mechanical stimuli which the osteopath may project upon them.

Recent investigations prove that many conditions which have previously been called inflammation are, in reality, congestions due to vaso-constrictor paralysis, and can be corrected by stimulation of the vaso-constrictor center governing the congested area; the stimulation of such center being secured by mechanical stimuli applied to the sensory nerves ending in the center.

The vaso-motor mechanism responds quickly to osteopathic manipulation, and is our means of correcting any disturbance of circulation both local and general.

Since the blood carries the nourishment for the tissues, and the vaso-motors control the distribution of the blood, the vaso-motor nerves are trophic nerves. In the same sense they are secretory nerves.

Capillary Circulation.—The capillary circulation is dependent on the state of the arterioles. Their walls are

formed by endothelial cells which are elastic, and hence respond to the force of the blood which enters them. If the vaso-constrictors are active in a local area the resistance offered to the passage of the blood current by the arterioles is increased, and therefore the pressure exerted on the capillary walls is lessened, allowing the capillaries to contract. If the vaso-constrictor influence over the arterioles be lessened, the blood current is allowed to exert its pressure on the capillary walls, thus increasing the calibre of the capillary.

If, in a large area of the body, vaso-constrictors are active, the influence of this resistance is felt by the heart, which immediately beats harder to overcome the resistance to the passage of the blood through the constricted arteries. The heart is usually relieved by compensatory dilatation of the arteries in some other area. The visceral and cutaneous arteries usually counter-balance each other in this way. This counter-balancing effect is probably brought about through the sensory impressions sent out from an overworked heart to the vaso-motor center, thus causing a lessened constrictor effect in some portion of the body.

The relaxation of all the arteries of the body would cause death, because the blood would gravitate to the most dependent part, and there is not blood enough to fill all the arteries when relaxed. A slight relaxation of general blood pressure causes the heart to beat more rapidly for a short time. Relaxation of the peripheral blood vessels is noted by the increased warmth and redness of the area in which relaxation takes place.

Recapitulation.—To recapitulate: (1) Capillary circulation is passive. (2) Vaso- constriction of the arterioles causes a decrease in the lumen of the capillary. (3) Vaso-dilation of the arterioles causes increase in the lumen of the capillary. (4) General vaso-constriction of the cutaneous blood vessels slows the heart and causes it to work against higher pressure, but the heart is relieved by relaxation of blood vessels in visceral areas, chiefly the splanchnics. (5) Decrease of constrictor effect on superficial vessels causes a more rapid heart beat, which is quickly controlled by constriction

in the splanchnic area. (6) The vaso-motor center in the medulla acts according to the sum of the sensory influences reaching it from all parts of the body. (7) The spinal vaso-motor centers act according to the influences sent to them by the chief center and the sensory impulses which enter their segment of the cord.

Vaso-motor Centers.—The vaso-motor centers for the various viscera, organs and members are as follows:

HEAD: The superior cervical ganglion.

EYE: The superior cervical ganglion through the fifth nerve.

NOSE, THROAT, TONSILS, TONGUE and GUMS: By the same path. Dilator fibres for the tongue per the lingual branch of the fifth cranial nerve.

BRAIN: "Sherrington and others have demonstrated the presence of vaso-motor nerves in the vessels of the brain. It is probable that the cerebral circulation is wholly dependent upon the general blood pressure, and, inasmuch as the general blood pressure is very markedly regulated by the capacious splanchnic area, it is obvious that the cerebral circulation may be better controlled by modifying the blood supply of the splanchnic area than by any attempts at the modification of the cerebral circulation itself."

Sympathetic fibres to the anterior and middle fossae come from the superior cervical ganglion per the carotid plexus. Sympathetic fibres are distributed to the vessels in the posterior fossa from the vertebral plexus which is formed by fibres from the inferior cervical ganglion.

THYROID GLAND: Middle and inferior cervical ganglion.

The vaso-constrictors for the blood vessels of the head, face and neck with their contained organs leave the spinal cord in the upper dorsal, second to fifth, and pass thence through the cervical ganglion.

LUNGS: Second to the sixth dorsal.

INTESTINES: The vaso-constrictors for the mesenteric blood vessels are found in the splanchnic nerves. Commencing at the fifth dorsal, there is a segmental distribution

to the various portions of the intestines. The lowest constrictor influence comes from the second lumbar. Vaso-dilator fibres are also found in the splanchnics.

LIVER: Sixth to tenth dorsal, right side.

KIDNEY: Tenth to twelfth dorsal.

SPLEEN: Ninth, tenth and eleventh dorsal, left side. The vagus is a motor nerve to the muscular fibres in the trabeculae of the spleen.

PORTAL SYSTEM: Fifth to ninth dorsal.

EXTERNAL GENERATIVE ORGANS: First and second lumbar, through the lumbar sympathetic ganglia, second to the fifth, to the hypogastric plexus, thence through the pelvic plexuses and pudic nerves to the generative organs. Function, vaso-constriction. First, second and third sacral nerves are vaso-dilators to the same organs.

INTERNAL GENERATIVE ORGANS: Vaso-constrictor influence at first and second lumbar.

ARTERIES TO THE SKIN OF THE BACK: Vaso-constrictor influence from sympathetic ganglion of the corresponding segment.

UPPER EXTREMITY: Vaso-constrictor influence to the skin, from second to the seventh dorsal.

LOWER EXTREMITY: Sixth dorsal to second lumbar.

MUSCLES: Dilator influence to the arteries of the muscles per motor nerves to the muscles.

Conclusions.—Vaso-motor nerves are of two classes, viz: Vaso-constrictor and vaso-dilator. *These nerves act according to the sum of the stimuli reaching their governing center over sensory nerves of skin, muscle and gland.* Therefore the osteopath depends on increasing or decreasing the stimuli reaching the spinal centers.

The heart is innervated by two sets of nerves which control it. These nerves arise from centers in the cerebro-spinal system and govern the action of the heart according to the sum of the stimuli reaching their centers over sensory nerves of skin, muscle and gland, and in harmony with the resistance maintained by the peripheral blood vessels.

Since perivascular tissues are dependent on the transfusion of nutriment from the blood, through the walls of the capillaries into the lymph, and this process of transfusion is dependent on the tension and speed of the current of blood in the capillaries, any condition which markedly increases or decreases this speed and tension will affect the nourishment of the tissues.

Pathology.—Our pathology is largely a study of hyperaemic and ischaemic conditions. Our methods of diagnosis ferret out these conditions quickly, and our therapeutics are planned to control them by purely scientific methods, i. e., by means of the nerves governing heart action and arterial tension. Where passive circulatory disturbances exist, attention is paid to the venous side of the circulatory apparatus.

Hyperaemia is probably the most prevalent disturbance of the circulation with which we come in contact. Such a condition as this is a predisposing factor in the establishment of bacterial inflammation. The hyperaemia weakens the resistance of the tissues in which it exists, thus furnishing the proper conditions for bacterial infection with resulting inflammation.

A study of hyperaemia is, in reality, a study of the vaso-motor mechanism. We have noted the fact of vaso-motor nerves controlling the calibre of blood vessels. These nerves are branches of the cerebro-spinal system. Most of them leave the spinal nerves and pass to the sympathetic spinal ganglia as rami-communicantes and then pass up and down to other ganglia of the sympathetic system. Some fibres return from the sympathetic to the spinal nerves and are distributed to blood vessels of skin, muscle and bone in the area of distribution of the spinal nerves. A few vaso-motor nerves do not enter the sympathetic system but pass directly to their destination with the spinal nerves. Thus two paths exist by which vaso-motor impulses reach the blood vessels, a direct route with the spinal nerves and an indirect one through the sympathetics.

Experimenters have long noted the return of vascular tone in an area whose vaso-constrictor nerves have been cut.

This return of vascular tonicity is supposed to be due to the presence of a perivascular mechanism which is capable of acting feebly after all other constrictor influences have been paralyzed.

So far as methods of treatment are concerned, we have paid very little attention to the presence of vaso-dilator nerves, but physiologists seem to prove that there are fibres leaving the cord with the posterior roots of the nerve trunks which act as dilators when irritated. The vaso-constrictor nerves are considered as constantly in action.

Irritation of the dilator nerves or paralysis of the constrictors will result in dilatation of the arterioles, so that the capillaries will be dilated to their fullest extent. Such a condition is called an "active hyperaemia." When the exit of the blood through the veins is obstructed and congestion results it is denoted "passive hyperaemia."

Acute or chronic hyperaemias as we note them in osteopathic practice, are usually originated by mechanical lesions, i. e., bony displacements which are either the result of accident, and hence primary lesions, or due to the unequal contraction of the attached muscles, and hence secondary lesions.

These bony and muscular lesions may also be the result of congestion in the mucosa of the intestines caused by the presence of indigestible substances.

The same irritants, mechanical, thermal and chemical, which are capable of stimulating muscles to unusual or unequal contractions so as to produce marked evidences of changed bony alignment, also cause such decided changes in the calibre of blood vessels as to cause tissues to become hyperaemic or ischaemic.

The majority of cases seen by the osteopaths are chronic, and the hyperaemic condition has been developed by slow degrees. Some slight but persistent lesion which shows itself to palpation will be found to be the cause.

If any hyperaemia exists in the mucosa of the stomach, palpation around the sixth dorsal spine will disclose tenderness. This spinal tenderness is probably due either to the

irritation of the dilator fibres which accompany the posterior division of the fifth dorsal nerve or to paralysis of the vaso-constrictors of that area. The resulting dilatation impinges on sensory nerves and causes tenderness. The irritation of sensory nerves in the mucosa of the stomach causes dilatation of blood vessels in that area and in the spinal area from which its sensory nerves arise. The irritation might have originated centrally and then involved the stomach, thus reversing the course of the irritation. These reflex hyperaemias are continually noted in practice, and it is through the reflexes that relief is obtained. One of the classical experiments to prove the reflex action of vaso-motor nerves is to immerse one hand in cold water, the temperature of the other hand will be lowered also.

It is quite generally conceded that the small arteries and arterioles in all parts of the body are supplied with vaso-motor nerves. Their presence in the blood vessels of the brain has been recently proven by G. C. Huber. His demonstration of vaso-motor nerves in the cerebral blood vessels explains many of the circulatory phenomena resulting from osteopathic manipulations.

Irritation of sensory nerves in any part of the body causes vascular dilatation in the irritated area. Physiological experiments seem to prove that vaso-dilator fibres accompany the sensory nerves, or that irritation of sensory nerves causes paralysis of vaso-constrictor nerves. Irritation of the nerves of one side of the body by pricking with a pin causes a rise of temperature on that side and a decrease on the unirritated side, thus demonstrating that vaso-dilation follows sensory irritation.

Experiments to note the effects of direct mechanical irritation of the stomach mucosa demonstrate that dilatation of gastric blood vessels follows mechanical irritation. The physiological hyperaemia thus produced is for purposes of increased secretion. It is well known that when this physiological congestion is continued without cessation as in the case when meals are frequent and full, the congestion becomes pathological, and the secretion of mucus is rapid. The liver

and intestines become chronically congested from similar causes. This hyperaemia leads to exudates and hyperplasia which further irritates sensory nerve endings and continues the dilatation of the arterioles. Thus a vicious cycle of reflexes is established which tends to ever increasing destructiveness.

When the sensory nerve terminals in the stomach are irritated and hyperaemia of the gastric vessels results, the influence of the irritation does not end with gastric congestion, i. e., if the hyperaemia be excessive, but causes dilatation of arteries in the spinal cord around the roots of sensory nerves distributed in other parts of the body which are supplied by branches of the same nerve trunk. The brain does not always note the real location of the irritation. It may refer the pain to any point supplied by a branch of the nerve trunk, one of whose branches is irritated. Thus in the presence of chronic congestion of the gastric mucosa, as in gastric catarrh, the irritation may not be intense enough to impress the brain with a painful sensation, but a slight increase of capillary pressure around the trunk of the sixth dorsal nerve such as would be brought about by digital pressure made upon the muscles around the sixth dorsal spine, would cause instant recognition of hyperaesthesia by the patient. Continued pressure made around the spine drives the blood out and lessens the sensitiveness. If hyperaemia has been intense enough to cause exudates, pressure increases the pain the longer it is continued, because the exudates have affected the venous circulation and there is no open path for exit of the blood.

From personal experience I should judge that it is quite probable that hyperaemia occurs along the whole course of the nerve and the nervi nervorum are rendered more sensitive thereby. In case of absolute neuritis, manipulation relieves the condition temporarily, but the pain increases shortly after the treatment is given. This shows that a condition exists which is much more difficult to change than a reflex hyperaemia.

Continued hyperaemic conditions cause increased nutrition, i. e., hyperplasia of connective tissue. Connective tissue seems to be more readily formed than any of the higher grades

of tissue. This may explain the rapid stiffening of the spine in cases of visceral hyperaemia.

The digital pressure test is an excellent method of differentiating the intensity of an hyperaemia. Even in cases of conscious pain in the gastric or intestinal areas, it is possible to use this test. In colic, deep pressure made gradually will give relief, but in cases of gastric ulcer or other inflammatory conditions, pressure aggravates the pain.

Therapeutics.—We now have before us an array of physiological facts and it remains for us to indicate how we shall use them.

The osteopath treats the vaso-motor nerves as though there were no dilator fibres to be reckoned with. Practically we consider that the vaso-constrictors are continually acting to maintain the "tone" of the blood vessels. Therefore, having only this one force with which to reckon, we consider all dilatation as vaso-constrictor paralysis.

We noted the fact that the cutaneous and visceral blood vessels were supplied with vaso-constrictors and that vaso-constriction in the superficial area was compensated for by dilatation in the deep area.

A large number of sensory impressions reaching the vaso-motor centers over the sensory nerves of the skin usually result in vaso-constriction of cutaneous blood vessels, hence internal congestion. Irritation of the sensory nerves in the skin may cause muscle under the skin to contract, thus obstructing the circulation in the skin. Therefore, our manipulations for vaso-motor effects naturally divide themselves into two classes: First, those which inhibit cutaneous reflexes; second, those which relax muscle in order to remove obstructions. This division is purely arbitrary on our part, but it serves to explain our work. We purposely leave out of this discussion the thought that we may have an osseous lesion causing our vaso-motor disturbance. We divide the spine into areas according to the predominating influence which issues from it, thus, the sub-occipital fossa is the first important area. It has long been know that pressure applied to this area in a case of congestive headache gives great relief. The good effects are

not lost when the pressure is removed. This proves that the effect of the pressure is on the nerves of that area, and that they are in close central connection with the vaso-motor center in the medulla. This center regulates the calibre of the arteries all over the body. It has been stated that pressure at the basi-occiput retards the blood flow to the brain, the pressure being on the vertebral arteries. We believe a careful examination of the atlas will convince one that in the average skeleton the groove for the vertebral artery is so deep and well protected that pressure on the surface of the neck cannot affect the artery. If our pressure effect is mechanical, why does the effect last so long? The blood stream is as swift as an ocean greyhound, and would rush into the partly filled vessel with its previous force, just the moment the pressure is removed. We can only explain the result by noting the fact that a change has been made in the entire circulation. Downward pressure on the carotids is also recommended to retard the blood flow to the head. This seems impracticable since the pressure cannot help affecting the venous return as well as the carotid stream. The best and most lasting effects are always vaso-motor.

It is a well recognized fact in the osteopathic profession that pressure in the suboccipital triangles causes a lessened blood pressure all over the body. This fact is made use of daily to lower the temperature of the body in cases of fever. If pressure had a mechanical rather than a nervous effect on the circulation, we could hope for no general effect, such as we do secure. This procedure is called inhibiting the vaso-motor center. Why does it inhibit? A "vascular tone" is normal in the body in order to keep the blood equally distributed. This "vascular tone" is easily disturbed since it acts according to the sum of the sensory impulses reaching the center in the medulla. Pressure in the suboccipital triangles affects not only the sum of the stimuli reaching the center, but, most important of all, affects the capillary circulation in this area which is in close nervous and circulatory connection with the medulla. Any external application, such as hot or cold water, local anaesthetics or counter-irritants must secure whatever

internal change may be manifested, by the effect these therapeutic procedures may have on cutaneous nerves.

Pressure in the sub-occipital triangles will relax the structures forming those triangles, thus lessening the sensory impulses entering the center from that source. The relaxed structures will hold more blood, hence they will in a slight degree relieve congestion of the center.

These triangles are the bilateral surface centers in which we operate to cause dilatation of vessels in the skin of the trunk and extremities. *We inhibit vaso-constriction of surface arteries.*

The next great constrictor area is the splanchnic, sixth to eleventh dorsal. This and the preceding area are the two points of vantage for the osteopath. Since the splanchnic nerves control a system of blood vessels whose combined capacity is equal to the entire amount of the blood in the body, we can quickly realize what it means to the general circulation to affect this area. In all cases of congestive headaches, fever, hyperaemia of visceral organs, etc., we "inhibit the splanchnics." Why? The reflexes between the skin of the back and the muscles of the back are so intense that they cause vascular constriction of the cutaneous arteries and contraction of the deep muscles of the back, thus adding a mechanical obstruction to the circulation of the blood in an already constricted area. Is it not possible, yea, probable, that this state of the surface tissue causes a congestion of the vaso-motor centers in the dorsal area of the cord, thus nullifying their control of the splanchnic area? Such a condition might be brought about by cold. The eating of indigestible food which remains a long time in the digestive tract may also be a cause.

The facts are as we have stated them, we inhibit over the splanchnic area to lessen the intensity of the reflexes in that area, thereby allowing the centers to regain their control. Remember that inhibition lessens the sensory impressions reaching a center and relaxes muscle both directly and indirectly.

Case Illustrations.—An illustration of osteopathic methods applied to hyperaemia is afforded by the following

case: A gentleman about fifty years of age was inspecting mines in the vicinity of Yuma, Arizona. He was of plethoric habit and hence the heat of that locality affected him quickly. About eight P. M., while in his tent preparing to bathe in order to get some relief from the intense heat, he felt a wave of weakness pass up his left side and almost instantly power of motion on that side was lost. Paralysis did not extend to the face. The gentleman was brought to Los Angeles and came under the best of medical treatment. Electricity and massage were tried with fair success, but the left arm and hand remained helpless and were carried in a sling. The hand was badly swollen and would pit under pressure, thus showing a marked degree of vaso-constrictor paralysis. The hand and arm had been thoroughly massaged for two months before osteopathic treatment was given. One hour's seance with the masseur would make a wonderful change in the hand, but the oedematous condition returned in a few hours. The fingers were bent into the palm, showing a marked tendency to a spastic condition.

From the medical standpoint it was considered sufficient for this case to have the local massage of the arm and hand, with administration of strychnine.

The osteopathic examination was made at the end of two months of the treatment just outlined. Slight signs of paralysis were noted at the angle of the mouth on the hemiplegic side. Examination of the neck showed marked contraction of the deep cervical muscles on the left side, extending from the occiput to the fourth cervical vertebra. Moderate digital pressure over these contracted muscles caused pain. There was also some tenderness as low as the sixth dorsal spine. The intense contraction and tenderness in the upper cervical region was noted as a secondary lesion existing as a result of a blood clot. It was reasoned that if these contracted muscles could be relaxed cerebral circulation would be equalized and more rapid absorption of the clot made possible. The spinal tenderness was brought about by the same law of irritation of sensory nerves we have previously stated. There was a dilated condition of the arterioles around the roots of the sensory

nerves in the cord similar in character to that which existed at the peripheral distribution of these nerves, especially in the hand. There was decided wrist and elbow reflex, showing that the subsidiary nerve cells in the cord were intact, but that either the cerebral motor areas or some part of their connecting paths were injured. The vascular tone of blood vessels in all other parts of the body was good, showing that the chief vaso-motor center in the medulla was acting. Here was a case showing a perfect reflex in the arm but loss of ability to will a motion; perfect sensation and vaso-motor paralysis.

Treatment was directed to securing relaxation of the contracted cervical muscles and to break up adhesions in the shoulder joint which had been allowed to stiffen. No treatment was given to the hand or arm. The patient was instructed to straighten the bent fingers with the well hand many times per day to overcome the spastic condition. Vaso-motor tone returned to the blood vessels of the hand in proportion to the amount of cervical relaxation accomplished. At the end of one month the hand was allowed to hang naturally, and scarcely any oedema was noticeable. Muscular control and power have steadily increased.

Another illustration is afforded by the following case: A gentleman suffering with inflammatory rheumatism in the second toe of the right foot sought relief by means of osteopathic treatment. He had used the salicylates in his previous attacks, but his stomach had become intolerant of them. The toe was red and angry looking, throbbing with pain and swollen to the size of the great toe.

Examination of the spine revealed tenderness between the fifth lumbar and third sacral spines, also between the second and third lumbar spines. Why should tenderness exist at these points? The answer according to anatomy and physiology is that these spinal areas mark the point of emergence from the spinal column of the anterior crural and great sciatic nerves which are distributed to equal parts of the affected toe. The sensory nerves being irritated by the deposit of faulty katabolic products in the tissues of the toe as the result of a slow blood stream. In this case the patient was caught out

in the rain and got his feet wet. The peripheral irritation of the sensory nerves caused dilatation of the arterioles and capillaries. The blood vessels around the roots of other sensory nerves which were branches of the same nerve trunks also dilated in response to this irritation, i. e., hyperaemia in the spinal cord was brought about at the point of origin of the anterior crural and great sciatic nerves, hence the sensory nerves to the skin and muscles of the back which are innervated from the same area of the cord as these great nerve trunks will also be tender to increased tension such as that secured by the digital pressure.

In a case such as this we do not desire to have the deposit in the toe taken up until the eliminating organs of the body are acting freely. To force it into the circulation before such time as it can be eliminated may result in inflaming another part. It is quite necessary that the throbbing pain be subdued so that sleep may be had. The patient soon learns to take advantage of venous circulation by elevating the foot. If pressure upon and a gentle relaxing movement of the muscles in the spinal area is made, there will quickly be noted a decrease in spinal sensitiveness followed by lessened conscious pain in the toe. It is quite probable that pain in the toe is due to hyperaemia; sensitiveness in the spinal area is due to the same sort of condition, the difference being in degree. It is impossible to prove the presence of these transitory hyperaemias by any direct observations any more than it is possible to prove by post mortem examination that hyperaemia or anaemia of the brain is present as a fixed pathological lesion in faulty functioning of the brain.

Pressure and relaxation in the spinal area draws the blood away from its position around the nerve trunk roots and thus stops many of the impulses which would originate centrally as a result of the irritation of sensory roots of the nerve trunk.

We usually think of these reflex sensitive areas of the spine as being evidence of the ability of all the branches of a nerve trunk to express some degree of the irritation being brought to bear on any one of the branches. It seems to me that in the light of what is known to happen in the area of

an irritated nerve, hyperaemia, that the same change in circulation may occur around the roots of its parent nerve trunk and be the sole reason for what we denominate a reflex pain.

By giving the heavy movement required to replace a subluxated vertebra or even to relax tense muscles around an otherwise normal articulation, it is quite probable that inexplicable changes are wrought in the circulation at these points which immediately changes the character of the nerve impulses originating or reflexing from this portion of the spinal cord.

CHAPTER V.

SECRETORY TISSUE.

Metabolism.—One of the attributes of the primitive cell is metabolism. We find it exemplified in the activity of those epithelial cells which are known under the general classification of secretory tissues. When studied under the microscope their protoplasm exhibits definite changes. The cell may not show any decided change in form, but the protoplasm manifests a change in its molecular composition.

The terms "gland" and "secretion" are very indefinite. Since it is possible that all tissues may give off secretions which are in some degree comparable to those discharged into the blood by the thyroid or adrenals, it is evident that the designation of secretory tissue as the representative of cell metabolism may be far short of the actual facts. However, the metabolism in secretory cells of glands which discharge their secretion on the surface can be readily studied. The knowledge of metabolic processes in the ductless glands is arrived at mainly by deduction.

Epithelium.—By right of age and extent of distribution secretory tissues should have held first place in this series of chapters on the Principles of Osteopathy. Secretory cells

are epithelial. Epithelial cells are the oldest in the body. There are animals which have no other kind of tissue. The first stages in the development of our own bodies are marked by the presence of two layers of epithelial tissue, the ectoderm and endoderm. Less histological change has occurred in epithelial cells than in any other tissues of the body. In other tissues we find the original form of the cells almost or completely lost. It has become subordinate to the functional activity of that which its activity has secreted. For example, we note the development of a muscle fiber. The original cell secretes "specific muscle substance" upon its surface. Just in proportion to the functional activity of the "specific muscle substance" do we find the original cell structure subordinate. Plain muscle fibers show merely a change in the form of the original cell. No striations have been formed. Heart muscle cells have secreted more "specific muscle substance" arranged in fibers, the nucleus and protoplasm have been crowded to one side by the structure which they have created. The completely striated muscle almost entirely supplants that which created it. Its nucleus and surrounding protoplasm are obscured.

We have noted how the original cells of our bodies have gradually surrendered various activities which the parent cell possessed. For each one to have retained all these characteristics would have resulted in mere bulk of tissue and each cell would have hindered the others. The differing products of protoplasmic activity have resulted in a specialization of tissues which makes for harmony and completeness.

Fig. 26.—Stratified squamous epithelium from human mouth. Drawn by A. M. Hewitt.

Protective Epithelium.—As before mentioned, epithelial cells show less histological change than other tissue cells. The original embryonal layers were epithelial, both

layers having an external surface. The epithelial cells form a protective covering, the skin. We find them forming the lining of the respiratory, digestive and renal tracts. In all these situations probably the first duty is protection. Removal of epithelium results in inflammation which continues until regeneration occurs. Destruction of considerable areas of epithelium, as by burns, may expose so many nerve endings that death results. Thinness of this covering has given rise to the expression, "her nerves are very near the surface," meaning that the nerves are easily stimulated.

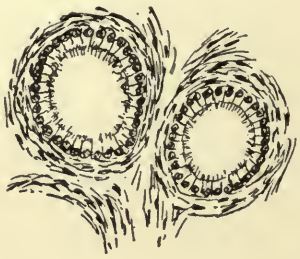


Fig. 27.—Ciliated columnar epithelium, vas epididymis. Drawn by J. E. Stuart, D. O.

Secretory Epithelium.—The position of epithelium on the surfaces of the body compels it to serve other purposes than protection. The katabolic products from the deep tissues must be passed to the surface and cast off by the epithelial cells, likewise all anabolic material for the life and growth of internal cells must be taken up by these surface cells. Most of the food material needs to be dissolved and chemically changed before being fit for the use of internal cells, therefore certain cells throw out protoplasmic products which bring about the proper changes in the food materials. As a result of these various duties performed by epithelial cells we have the words *"excretory"* and *"secretory,"* both coming under the general head *glandular epithelia,* or as we have entitled this chapter, *secretory tissue.*

Sensory Epithelium.—A third duty of epithelial tissues is to receive impressions from the outside world, and stimulate sensation. The functions of seeing, hearing, tast-

ing, smelling and touching are dependent on special arrangements of epithelial cells called sensory epithelia.

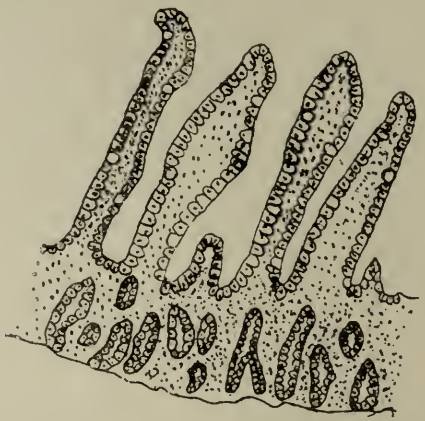


Fig. 28.—Section of ileum of a cat showing glandular epithelia. Drawn by A. M. Hewitt.

Gland Formation.—The simplest arrangement of glandular epithelium is found where "gland cells" are scat-

Fig. 29.—Retina of a cat's eye showing sensory epithelia. Drawn by A. M. Hewitt.

tered here and there among the ordinary epithelial. For example, the goblet cells found in the mucous membrane. The

protoplasm of these goblet cells produces the slimy substance known as "mucus." The mucus is accumulated within the cell capsule until the tension becomes so great that the capsule breaks and the protoplasmic product is discharged upon the surface of the membrane. When the cells of protective epithelium are sufficiently interspersed with gland cells it is called a glandular membrane. A vertical section of such a membrane shows the "goblet cells" crowded away from the surface but a slender prolongation gives them access to it. When many glandular cells are collected together, invagination occurs, thus increasing the extent of surface. Such a formation is called a multicellular gland. This method of invagination may cease in its simple tubular form, or proceed to the formation of extensive organs like the salivary glands, pancreas or liver.

Sexual Cells.—The sexual cells are found among epithelial cells. Since epithelial tissue is the oldest and the least changed, it is not surprising that sexual cells should be found generated in relation with this form of tissue. Sexual cells tend to form invaginations similar to those formed by glandular cells, hence the use of the term sexual glands.

Summary.—Since we find that epithelial tissue acts as a protection to all other tissues, that excretion and secretion are carried on by it, that some cells are so highly specialized that our special senses are dependent upon them, we realize how extensively we depend upon the integrity of this tissue. Its position at once places it in relation with external stimuli and internal activity. It is most closely associated with the central nervous system, therefore we can expect to secure far-reaching results by bringing our therapeutic methods to bear on this surface tissue.

Arrangement of Gland Cells.—We will consider only those glands which give off an external secretion. They consist of epithelial cells arranged with definite relations to a basement membrane, on the other side of which is placed a net work of blood vessels. The secretion is selected from the lymph which bathes the cells, and is poured out on the free surface.

All glands have the general structure just described but are oftentimes complicated in arrangement to suit the special function required. Just as the arrangement of glands varies, their secretions also vary.

Filtration, Osmosis and Diffusion.—If we go back to the early study of secretory tissues we find the investigators describing secretion as a process of filtration, osmosis or diffusion. The basement membrane was supposed to affect the liquids passing through it, the differences in its intricate structure accounting for the differences in the various secretions. The explanations of all physiological processes have been at one time expounded on a purely physical basis. Text books of ten years ago had very little to say in support of selective power of secretory cells. They were given an entirely passive roll. Our modern text books lay great stress on the part played by individual cells in the production of the characteristic secretions of definite glands. Close study of nerve endings when stained by the golgi method has revealed the wealth of nerve arborizations around epithelial cells. Thus it is noted that each cell is an important active unit in the work of the gland and that its perfect work is necessary for the successful action of the gland as a whole. Without our knowledge of this intimate connection between individual cells and the nervous system it would be hard to comprehend the physiological action of glands. So long as our knowledge took cognizance only of the general relation of cell to basement membrane and blood supply it was thought that the phenomena of filtration, osmosis and diffusion were sufficient explanation. If this were all, then vaso-motion, which regulates blood pressure, would be the mechanism by which secretion is controlled.

The Individual Cell.—Physiologists had observed phenomena which were not explainable by the methods just mentioned. The pressures in the blood and secretions did not bear the proper relations to each other, in fact they were reversed, this necessitated a complete reconstruction of theories in regard to secretion. The individual cell now takes its position as a vital factor in the activity of the gland and it acts,

not according to blood pressure on the hither side of its basement membrane, but according to the governing impulse which reaches it over a nerve fiber which proceeds from a center of control. This center of normal control acts according to the sum of the stimuli reaching it from other centers.

Secretory Fibers.—It is practically impossible to demonstrate the presence of secretory fibers to all glands. It is difficult to separate the vaso-motor and secretory fibers even in those glands where the dual action is best demonstrated. Since true secretory fibers are known to exist in a few cases, physiologists are not slow to concede the probability that they are present in all cases.

The microscope is able to demonstrate the direct participation of certain epithelial cells in the formation of the secretion from certain glands. The goblet cells can be studied as they discharge their mucous on the surface, likewise the cells in sebaceous and mammary glands.

It is quite probable that not only the organic constituents of the secretions, but the amount of water and salts also are under the control of secretory nerves. For the experiments upon which these statements are based any of the recent physiological text books will furnish the data.

The New View-point.—The students of ten years ago who studied carefully the phenomena of diffusion, osmosis or filtration find now very little emphasis placed upon these physical explanations of the phenomena of respiration, absorption or secretion. A new physiological view-point has been formed which gives to the individual cells an importance hitherto ignored, and likewise gives us understanding of the far-reaching control of the nervous system, which makes us conscious of the fact that we are not a collection of mechanical devices exemplifying physical laws but a co-ordinated mechanism, essentially vital, acting according to psychical as well as mechanical, thermal and chemical stimuli.

When we have thoroughly incorporated in our minds the fact that the phenomena manifested in the manifold activities of our bodies have a vital and a physical side we are prepared to study physiology without losing our balance be-

cause of fixing our attention too much on one side or the other.

Necessary Conditions for Secretion.—Every gland requires four conditions for its proper activity; (1) proper structure, i. e., it must have inherited normal power; (2) unimpeded blood supply; (3) the normal elements of its secretion must be in its blood supply; (4) perfect nerve control.

As physicians we view every perversion of secretory tissue in the light of these four requisites for perfect action.

If the first condition exists we can do nothing toward remedying the deficiency but in some cases we can supply a substitute for the normal secretion of the defective glands. Sebaceous glands are frequently lacking and hence the skin is dry and harsh. It is the duty of the physician to supply a substitute for the product of these glands.

Classes of Drugs Which Affect Secretion.—Nearly all diseases are characterized by some excess, defect or perversion of secretion and the major portion of therapeutic procedures are directly addressed to the alleviation of these conditions. Drug therapy is dependent on the action of chemicals to right the difficulties. We have only to note the names of classes of drugs to realize how extensively they are used to control secretion. Astringents, tonics, cathartics, diuretics, diaphoretics, expectorants, emmenagogues, sialagogues, errhines, etc., each drug in every class being a more or less intense poison. If it were not poisonous it would not act so promptly. It is not a food, hence cannot become incorporated in the protoplasm of the body cells. Being a foreign substance, our bodies attempt to dissolve and eliminate it. Why pilocarpin is eliminated in the saliva and sweat in preference to the alimentary tract or kidneys is difficult to explain but the fact that it is forced out of the body as quickly as possible ought to be sufficient evidence against using it. Drugs which promote secretion, do so at the expense of the vitality of the body. They call forth an excessive amount of energy in order to be ejected from the body.

It seems to us that a sufficient number of cases have been

treated successfully by physiological means to warrant the cessation of the use of drugs.

Unimpeded Blood Supply.—The second necessary condition for normal secretory activity has been stated as an unimpeded blood supply. This is a prerequisite for good functioning which cannot be ignored. This question of circulation is the basis of osteopathic practice, therefore we examine every case with special attention, knowing that if the proper amount of blood is not furnished to the secretory tissues, under a proper speed and tension, improper functioning will result. We know that the blood stream is subject to many influences of a mechanical character, external pressures exerted by subluxated bones, contracted muscles, etc., but far in excess of these purely structural difficulties we find that the influence of vaso-motor nerves is a condition which requires our attention. Secretory cells depend on the blood being brought to them under a certain pressure and speed. These conditions of the blood stream are governed largely by the vaso-motors. Vaso-motors act according to stimuli reaching their governing centers over sensory nerves ending in all the body tissues, but principally those ending in skin, mucous membrane and muscle. These sensory nerves are subject to mechanical, thermal and chemical stimuli. Therefore our search for causes of abnormal secretion compels us to investigate not only the prominent symptoms of the case but to note the structural conditions along the course of the nerves which control the secretory tissue. Palpation will usually discover some lesion which is the result of intense mechanical, thermal or chemical stimulation. The history of the case will frequently aid us in learning what the original stimulus was.

Proper Food.—The third prerequisite for perfect secretion is the presence of proper elements in the blood to supply the needs of the secretory cells. The cases are very few in which the blood does not contain sufficient materials out of which the secretion may be formed. The secretion of the mammary glands requires large amounts of proper food material in their blood supply. The treatment of defective or perverted mammary activity is frequently dietetic. After all

obstructions to the blood supply have been removed, the quality of the blood must be considered. Quality, elaboration being normal, depends on the food eaten.

Innervation.—The last condition, not in order of importance, necessary for proper secretion, is proper innervation. This fact is the recent addition to our knowledge of the mechanism of secretion. Its great importance can be grasped in an instant and makes the osteopathic idea of secretion and its control appear decidedly rational.

Many phenomena heretofore unexplainable are now clearly understood by physiologists. So long as secretion was believed to be controlled by vaso-motor nerves it was difficult to account for the lack of perspiration while the blood vessels of the skin are full of blood, or why the skin should perspire when pallid and bloodless.

Knowledge of secretory nerves has been in the possession of scientists for fifty years. In 1851 Ludwig demonstrated that stimulation of the chorda tympani nerve caused a rapid secretion from the submaxillary gland. Beginning with this important discovery experiments have been made to confirm a like control to other glands. Sufficient proof has been secured to establish nerve control as one of the important factors in the activity of secretory tissue.

The secretory and vaso-motor nerves are usually in the same nerve bundle, hence experimentation with them independently is a difficult matter. The structural lesions found in connection with the perverted secretion usually exert an equal influence on both sets of nerves. It appears that both sets of nerves are not equally responsive to thermal or chemical stimuli as may be noted by the clinical picture of fever, hot dry skin. The addition of heat for therapeutic purposes succeeds in arousing the secretory cells in the skin and perspiration starts. The use of heat to excite perspiration is an excellent therapeutic procedure. It affects secretion reflexly, i. e., the sensory nerves of skin convey impressions to the central nervous system and then a change in the tension of the blood vessels on the surface takes place, together with an increase in the activity of the sweat glands.

Osteopathic Pathology.—Since so much is said about the necessity for a perfect circulation our readers may gain the impression that osteopathic pathology is entirely "humoral" in character. We do not wish this idea to become fixed in your minds. It is sufficient to call your attention to the stress put upon the facts set forth in this chapter that the integrity of the individual cell is all important, that the individual cells are governed by nerve influence, and if this influence be perverted they may refuse that which is brought to them by the blood. The fact that all cells can secrete while blood vessels are tied and some times fail to secrete when blood vessels are full, demonstrates a two-fold influence controlling secretion, one over the cell, the other over the blood vessel. Thus we note that osteopathic pathology is as much "cellular" as "humoral."

Therapeutics.—Having taken this general view of the conditions necessary for normal secretory activity we may note some of the general principles of therapeutics used to correct abnormalities.

First, the blood must circulate actively in order to maintain its vitality. Sluggishly moving blood, as in conditions where venous circulation is interfered with, is not conducive to good secretion.

Second, a moderate increase in the circulation in a gland usually increases its activity, i. e., vascularity, within certain limits is conducive to perfect physiological action.

Our therapeutics comprehend the safest and hence the best means of regulating the circulation in secretory tissues.

There is no doubt that the pharmacopeia records many drugs whose action is rapid and effective so far as securing activity or decrease of secretion is concerned, but the element of danger, i. e., their destructive power is great. Oftentimes their action does not stop at the point desired or limit its effect to the therapeutic action sought.

Direct Manipulation.—The simplest way of increasing the amount of blood in a secretory tissue is by direct manipulation. Simple massage of a mammary gland will greatly increase the amount of blood in it. This direct manipulation is

only transitory in its effect and hence not used by the osteopath.

Hyperaemia of the Governing Center.—Stimulation of the circulation in a gland may be secured by increasing the amount of blood in its governing center in the nervous system. In order to use this form of stimulation successfully one must possess an extensive knowledge of the connections of the gland with the nervous system, also a knowledge of the blood vessels of the gland.

Effect on Heart Beat—Any manipulation which does not affect the heart beat and hence the initial force of the blood current will not have a lasting effect in a local area. All manipulations which aim to affect the circulation of a gland must be intense and prolonged sufficiently to bring about a general readjustment of the circulation. The force of the heart beat and the resistance of the arterioles must both be affected. Such an effect will tend toward permanency.

The circulation of definite areas is governed within fairly well marked areas of the spinal cord and we can effect these areas by indirect manipulations, but it would not be conducive to the benefit of the whole body if one portion of it could be permanently excited or depressed by any therapeutic means whatsoever; co-operation of all portions is necessary to maintain the activity of any one portion. This fact proves that our therapeutics must be far-reaching in their effects. Therefore to increase the activity of a gland we must affect not only the tension of the blood vessels by means of vaso-motor nerves but also the force of the blood stream, the *vis a tergo* given it by the heart. True it is that the tension quickly reacts on the heart but clinical practice demonstrates that a longer effect is secured if both factors in the circulation are directly affected by manipulation.

Classes of Stimuli.—Since secretory tissues are under the control of secretory and vaso-motor nerves, and these nerves respond to at least five forms of stimuli, our therapeutic procedures may comprehend one or all of these forms of stimuli. The five forms are, mechanical, thermal, chemical,

electrical and psychical. The osteopath uses all of these. Mechanical and thermal are the principle forms.

Manipulation being the special therapeutic means used by the osteopath, we do not desire to take your time and attention in a discussion of the other means of affecting secretory activity which are discussed at length in many useful volumes.

Perspiration.—The secretion of the skin, perspiration, is a profound regulating factor in the health of every individual. Its normal activity must be maintained at all times. We are called upon frequently to either increase or check it. The treatment of fever is largely comprehended in the increase of this secretion for purposes of heat elimination. When we succeed in affecting the respiratory glands so that they will accept the material brought to them by the cutaneous blood vessels we have in large measure solved the problem of secretion in the kidneys. Any therapeutic procedure which favorably affects the blood tension in the skin also affects the tension in the kidneys, hence our treatment is not addressed primarily to either system of secretory cells but to the readjustment of speed and tension of the blood stream throughout the body. The cardiac centers and large vasomotor centers are the points which we desire to affect, depending on the readjustment of tension in the peripheral blood vessels to secure the desired results.

Clinical experience seems to demonstrate that perspiration can best be established by manipulation in the interscapular area, i. e., between the first and seventh dorsal vertebrae. A relaxation of the muscles in that area will frequently be followed by gentle perspiration over the entire body. This result is probably brought about by the inhibitory effect of the manipulation around the first dorsal spine, the cardiac accelerator center. It is also probably due to the fact that the vaso-constrictor fibers to the blood vessels of the head, neck, upper portion of the trunk and upper extremities pass out of the spinal cord between the second and seventh dorsal vertebrae. We have never seen a case of fever in which this manipulation was not at least partially beneficial. Its effects

are far-reaching. The average case of la grippe will yield to this treatment almost immediately if the treatment is given on the day of the attack.

It is well known that fear, intense mental or physical pain will cause profuse perspiration and pallor of the skin. At rare intervals a case is seen where perspiration is intense during the sleeping hours and no mental or physical pain is experienced, nor is there any tuberculous infection. In all these cases the perspiration is a reflex condition and hence our manipulation must be addressed to the causative factor. Perspiration caused by pain is the most easily relieved by inhibition of the pain. Heat may take the place of inhibition.

Secretion in the Digestive Tract.—Too much or too scanty secretion in the digestive tract is the most common condition we have to deal with. Excessive intestinal secretion, as in diarrhoea, is in all probability more quickly and successfully treated by manipulation than by any other means. In this condition the secretory cells seem to be directly under the control of the spinal centers and respond almost immediately to inhibitory pressure over these centers.

In the treatment of lack of intestinal secretion many factors must be considered. The average case which comes to us with this complaint has been drugged to such a point that the integrity of the secretory apparatus is affected. Over stimulation by chemical means has resulted in atrophy of secretory cells.

We must bear in mind that a large proportion of the so-called diseases we are called upon to treat are drug diseases. Structure has many times been ruined by the use of drugs. hence we fail because the mechanism is destroyed.

Pulmonary Respiration.—One more point in regard to secretion, i. e., the selective power of cells requires our earnest thought and attention. Respiration is a secretory process. Therefore our treatment must comprehend the same principles as have been noted in relation to other secretory tissues.

Importance of the Cell.—The all importance of the cell and its harmonious working with its fellows seems to us to lend a new dignity and power to the position now being

won by osteopathy. The treatment of disease according to the light of physiological knowledge is the system of therapeutics which will win the confidence of the world. Osteopathy is winning that confidence.

CHAPTER VI.

THE SYMPATHETIC NERVOUS SYSTEM.

Unity of the Nervous System.—It gives a wrong impression to speak of the CEREBRO-SPINAL NERVOUS SYSTEM and the SYMPATHETIC NERVOUS SYSTEM, as though they are independent of each other. They are parts of a single system. They make all parts of the body intercommunicative, and make it possible for a slight stimulus to cause a widespread response. They convey all impulses of a sensory character to the central nerve cells and cause internal activity and response to external stimuli. In fact, the harmonious action of the tissues in our body depends on every cell knowing the condition of every other cell. Each cell is capable of perfect life only so long as it is able to communicate with the central nervous system, ready to give and to receive, thus fulfilling the law of reciprocity.

For convenience of description, the nervous system is divided into the cerebro-spinal and the sympathetic. We have already said that these are parts of one whole. They are continuous anatomically and physiologically. In the attempt to write of them separately, we desire you to bear constantly in mind their interdependence.

"The dependence and independence of the cerebro-spinal and sympathetic system of nerves may be compared to the State and Federal Governments, or the Municipal and State Governments. The former run in harmony, when friction

does not arise, yet the State lives quite a distinct, individual life—quite independent of the Federal Government. And the life of each is dependent, however, on the other. The internal life of each (as of the sympathetic) maintains itself."—Byron Robinson in the "Abdominal Brain," page 55.

Origin.—The sympathetic appears to originate from the ganglia on the posterior roots of the spinal nerves.

(1) **Lateral Ganglia.**—The substance of the sympathetic is conveniently divided into four portions: (1) The lateral chains of ganglia, placed one on each side of the vertebral column. The chains are connected above by the Ganglion of Ribes (French, 1800-1864), situated on the anterior communicating artery, and joined below by the Ganglion Impar situated on the anterior surface of the coccyx. These chains of ganglia are connected with the cerebro-spinal nerves by well marked cords.

(2) **Four Prevertebral Plexuses.**—The next prominent aggregations of nerve tissue are the great prevertebral plexuses situated ventral to the bodies of the vertebrae. The FIRST, or Pharyngeal, is situated around the larynx. The SECOND, or Cardio-Pulmonary Plexus, lies in the thorax. The THIRD, or Solar Plexus, encircles the Coeliac Axis and superior mesenteric artery. The FOURTH is the Pelvic Plexus, which governs the generative organs and rectum.

(3) **Visceral Ganglia.**—The third part of the sympathetic tissue is composed of those ganglia placed between the coats of viscera, and called the peripheral apparatus or "Automatic Visceral Ganglia." (Robinson.)

(4) **Communicating Fibers.**—All of these ganglia and plexuses are intimately connected with each other by numerous nerve fibres. These four parts constitute what is commonly known as the SYMPATHETIC NERVOUS SYSTEM. The nerve fibres in the sympathetic system consist of both the medullated and non-medullated varieties, i. e., white and gray. It is commonly believed that the white are cerebro-spinal and the gray are sympathetic fibres, though whether they belong to the one or other system cannot be told by appearance alone. Function must also be considered. The

fibres in the sympathetic system are principally of the non-medullated variety; hence, gray fibres are called sympathetic.

White Rami-communicantes.—The chains of the lateral ganglia are connected with the spinal nerves serially by two distinct nerve bundles to each ganglion. These bundles are called rami-communicantes, and are composed of: (1) A bundle of white or cerebro-spinal fibres passing from the anterior and posterior roots of the spinal nerves to the ganglion, in which a few fibres may end; but the majority pass on to be distributed to the prevertebral plexuses, thereby giving direct communication between viscera and the spinal cord. These white fibres consist of both motor and sensory fibres. THE WHITE RAMI-COMMUNICANTES LEAVE THE SPINAL CORD BETWEEN THE SECOND DORSAL AND SECOND LUMBAR VERTEBRAE ONLY. Many of the fibres are de-medullated in the lateral ganglia; others retain their sheaths as far as the prevertebral plexuses, where they also become de-medullated. The cervical region has no white rami-communicantes.

Distribution.—The nerves in the sacral region which correspond to white rami-communicantes, pass to the viscera without entering the sympathetic ganglia. We may summarize what we have written concerning the ending of the white rami-communicantes as follows: (1) End in the lateral ganglia. (2) Pass through lateral ganglia and end in prevertebral plexuses. (3) Split up before entering lateral ganglia and send some fibres to the ganglia, others to ganglia above and below, after passing into its own ganglia.

Function.—The white rami-communicantes have many functions, and these can be determined by a close study of distribution and physiological action. The functions may be tabulated approximately as follows: *First,* it has been demonstrated that vaso-constrictors pass out of the cord between the second dorsal and second lumbar vertebrae; *second,* cardiac augmentors, ending in the lower cervical ganglia and first thoracic ganglion; *third,* motor fibres to the plain muscles of the intestines; *fourth,* motor fibres to the sphincter of the iris leave the cord at the third dorsal and ascend in the

chain of sympathetic ganglia; *fifth,* inhibitory fibres to the viscera; *sixth,* sensory fibres from viscera.

In other words, it may be tabulated as follows: The abdominal splanchnics contain viscero-motor and viscero-inhibitory, vaso-constrictor, vaso-dilator and sensory fibres, which are white rami-communicantes. Since no white rami-communicantes leave the cord above the second dorsal or below the second lumbar, the cardiac augmentors and the constrictors to the spincters of the iris probably leave the cord as white rami-communicantes in the dorsal region.

We have thus far considered only those fibres which are supposed to originate in the cerebro-spinal system; at least, they are medullated nerves, and hence are considered cerebro-spinal in character.

As we have previously stated, the bond of union between the sympathetic and cerebro-spinal systems consists of a white and gray bundle.

Gray Rami-communicantes.—These gray fibres are non-medullated and originate in the lateral ganglia, being axis cylinder processes of nerve cells in those ganglia, passing thence to the spinal nerves and spinal cord.

Distribution.—They pass first to the anterior, primary divisions of the spinal nerves and continue with them to their distributive area; or they may pass to the distribution area of the posterior division, to the distribution area of the recurrent branch of the spinal nerve, and to the structures (dura) surrounding the posterior root of the spinal nerve and to the spinal cord.

Function.—Since the function of the sympathetic system is to control the calibre of blood vessels, the plain muscle fibres, and the action of the secretory and excretory glands, we may state the function of these gray rami-communicantes to be as follows: (1) Vaso-motor to the blood vessels of the skin and skeletal muscles in the area of distribution of spinal nerves; also secretory to the sweat glands, and motor to the plain muscle controlling the hairs; (2) vaso-motor to the blood vessels in the spinal cord and its membranes. The nerves passing from the lateral ganglia to the prevertebral

plexuses, therefore, contain white and gray fibres having the functions of the sympathetic and cerebro-spinal systems, and from these prevertebral plexuses, fibres pass to the distal ganglia in the walls of the viscera. Thus we see that all the ganglia of the sympathetic are closely connected with the cerebro-spinal. These ganglia demedullate the spinal nerves which enter them, and more fibres leave the ganglia than enter them. These ganglia have a trophic influence over the nerves which originate in them, and which pass from them to the periphery. They are reflex centers.

Functions of the Sympathetic System.—"In general it may be said that the sympathetic presides over involuntary movements, nutrition and secretion, holds an important influence over temperature and vaso-motor action, and is endowed with a dull sensibility." (Robinson's "Abdominal Brain.")

Independent or Dependent.—Whether the action of the sympathetic is independent or dependent is no longer subject for experiment and discussion. You have seen the heart beat after extirpation from the body; also the vermicular motion of the intestines. These are offered as evidences of independent action; but it must be borne in mind that under normal conditions the cerebro-spinal nerves can influence these activities, either repressing or augmenting them.

Ganglia.—The ganglia of the sympathetic contain (a) nerve cells, (b) afferent fibres, (c) efferent fibres—and are therefore governing centers. They are able to receive sensation, and transform this into motor impulses, and hence are, in a measure, independent.

Cervical Ganglia of Importance to Osteopaths.—The cervical portion of the gangliated cord contains three ganglia which are designated as superior, middle and inferior, according to position. These ganglia are important to the osteopath, because they are in a measure affected by direct manipulation, i. e., pressure can be transmitted to them through the soft tissues over them.

Superior Cervical Ganglion.—The superior cervical

ganglion lies on the rectus capitis anticus major muscle and sends branches upward which form a plexus around the internal carotid artery (carotid plexus). The cavernous plexus is a continuation of this. From these plexuses many communicating branches pass to unite with the cranial nerves of the cerebro-spinal system.

Connections.—This ganglion is connected with the first four spinal nerves, and the ninth, tenth and twelfth cranial. Its branches are distributed on all the blood vessels of the head and face.

Vaso-constriction.—Physiological experiment has demonstrated that this ganglion exercises a vaso-constrictor influence over the blood vessels of the head and face.

Distribution.—"The terminal filaments from the carotid and cavernous plexuses are prolonged along the internal carotid artery, forming plexuses which entwine around the cerebral and ophthalmic arteries; along the former vessels they may be traced into the pia mater; along the latter, into the orbit, where they accompany each of the subdivisions of the vessel, a separate plexus passing with the arteria centralis retinae, into the interior of the eye-ball. The filaments prolonged onto the anterior communicating artery form a small ganglion, the Ganglion of Ribes, which serves, as mentioned above, to connect the sympathetic nerve of the right and left side." (Gray's Anatomy, page 871.)

Reasoning from the position of the ganglion, in the neck, its distribution to blood vessels of the head and face, and its vaso-constrictor functions to the vessels, we can readily understand why mechanical lesions in the upper cervical region can be the cause of grave pathological conditions in the tissues of the head and face. Anything which disturbs the normal circulation in a definite area will necessarily affect the nutrition of the tissues in that area; therefore, nutritional disorders of the eye are found to be caused by subluxation of vertebrae, or contraction of muscles in relation to the superior cervical ganglion.

Headache.—Since sympathetic branches are distributed to the blood vessels of the pia mater, we may reasonably

expect to affect the calibre of these vessels in the case of congestive headache, by removing all obstructions,—e. g., contracted muscles causing dilatation,—to the active functioning of the superior cervical ganglion. The distribution of these sympathetic nerves to the orbit, nose, pharynx, tonsils, palate, and sinuses, explains the possibility—yes, probability—of a mechanical lesion in the upper cervical region in these cases.

Middle Cervical Ganglion.—The middle cervical ganglion is the smallest of the three. "It is placed opposite the sixth cervical vertebra, usually upon or close to the superior thyroid artery; hence the name of 'Thyroid Ganglion' assigned to it by Haller." It sends branches to the fifth and sixth spinal nerves.

Distribution.—It sends branches to accompany the inferior thyroid artery to the thyroid gland, where they communicate with the superior and recurrent laryngeal nerves. These branches regulate the calibre of the inferior thyroid artery and its branches. The chief nerve trunk passing from this ganglion is the middle cardiac nerve. The cardiac augmentors leave the spinal cord as white rami-communicantes to the second, third and fourth dorsal ganglia, then pass upward to the middle cervical ganglion. This ganglion is connected with the superior cervical ganglion.

Function.—The functions of this ganglion are (a) vaso-constrictor (through connection with the superior cervical ganglion) to the blood vessels of the head and face; (b) vaso-constrictor to the vessels of the thyroid gland; (c) augmentor influence to the heart.

Manipulation.—Therefore, inhibition (pressure) will lessen those influences, and stimulation (make-and-break pressure) will increase them. Since sympathetic centers (ganglia) control vaso-motion and secretion, we may consider that this ganglion controls vaso-motion and perspiration in the area of distribution of the fifth and sixth cervical spinal nerves.

Inferior Cervical Ganglion.—"The inferior cervical ganglion is situated between the base of the transverse pro-

cess of the last cervical vertebra and the neck of the first rib, on the inner side of the superior intercostal artery."

Distribution.—It connects with the ganglion above, and the fibres which connect it with the first thoracic ganglion pass both in front of and behind the subclavian artery. Its chief branch is the inferior cardiac nerve, which communicates with the middle cardiac nerve and the recurrent laryngeal nerve. It sends gray rami-communicantes to the seventh and eighth cervical nerves; also some branches which pass upward to the vertebral artery. The fibres which encircle the subclavian artery are called the Annulus of Vieussens, and some fibres to the cardiac nerve are given off from it.

Function.—From this distribution we may draw the following conclusions as to the function of the inferior cervical ganglion; (a) It is vaso-motor to the area of distribution of the seventh and eighth cervical nerves; (b) it controls perspiration in this same area; (c) it is vaso-motor to the vertebral artery and its branches in the posterior fossa of the skull; (d) vaso-motor to the internal mammary, inferior thyroid, and nervi comes phrenici arteries; (e) augmentor influences to the heart.

Manipulation.—Treatment on this ganglion would lessen its vaso-constrictor influence over the arteries named, and they would then carry more blood at a slower rate. The stimulation of this ganglion would raise blood pressure in the area it controls, and augment the force of the heart.

Recapitulation.—It has been mentioned that the cervical ganglia receive no white rami-communicantes from the cervical nerves, and that vaso-constrictor fibres pass from cerebro-spinal to the sympathetic system in the white rami-communicantes between second dorsal and second lumbar vertebrae; therefore, the constrictor influence manifested by the cervical sympathetics is derived from the second, third and fourth dorsal. They derive fibres also from the upper thoracic region, as follows: (a) augmentor fibres to the heart from the second, third and fourth dorsal; (b) secretory fibres to the salivary glands, second and third dorsal; (c) pupilo-dilator and motor fibres to the involuntary muscles of

the eye and orbit from second and third dorsal; (d) afferent fibres whose stimulation causes activity of the vaso-motor center in the medulla.

Thoracic Ganglia.—"The thoracic portion of the gangliated cord consists of a series of ganglia which usually correspond in number to that of the vertebrae, but from the occasional coalescence of two, their number is uncertain. These ganglia are placed on each side of the spine, resting against the head of the rib and covered by the pleura costalis; the last two are, however, anterior to the rest, being placed on the sides of the bodies of the eleventh and twelfth dorsal vertebrae. The ganglia are small in size, and of a gray color. The first, larger than the rest, is of an elongated form, and frequently blended with the last cervical. They are connected together by cord-like prolongations of their substance. In the thoracic region the ganglia are connected with the spinal nerves by both white and gray rami-communicantes."—(Gray's Anatomy, Page 804 in 1901 Edition.)

Rami-efferentes.—The rami-efferentes or branches of distribution, are divided into an internal and external set. The external branches are smaller, being distributed to the bodies of the vertebrae and their ligaments. The internal branches may properly be divided into an upper and lower group, which are distributed to the viscera of the thorax and abdomen.

Upper Five Thoracic Ganglia.—The upper five thoracic ganglia send branches which are distributed around the upper portion of the descending aorta. From the second, third and fourth ganglia are given branches to the posterior pulmonary plexus, which control the tissues of the lungs. You will remember that the pneumogastric nerves are the motor, sensory and trophic nerves to the air passages. The sympathetic, second to seventh dorsal, are vaso-motor and trophic to the blood vessels of the tissues of the lungs. We have now laid a foundation of anatomical and physiological facts upon which we may base our principles of treatment. The upper thoracic region is an important one, because in it we find not only those white rami-communicantes which are distributed to the aorta

and lungs, joining with the pneumogastric nerve to complete the plexuses which control lung action, but also those white rami-communicantes which ascend to the cervical ganglia, and are distributed as follows:

Nerve Distribution.—"(1) Pupilo-dilator fibres pass by rami-communicantes from the first, second and third thoracic nerves, ascend in the sympathetic cord to the superior cervical ganglion to form arborizations around the cells. These gray fibres pass to the Gasserian Ganglion and reach the eye ball by the ophthalmic division of the fifth and long ciliary nerves; (2) motor fibres to the involuntary muscles to the orbit and eyelids, from the fourth and fifth thoracic nerves, following a similar course; (3) vaso-motor fibres to the head, secretory fibres to the submaxillary glands, and pilo-motor fibres to the head and neck, are derived from the upper thoracic nerve, and reach their area of distribution, after similar interruption, in the superior cervical ganglion; (4) the accelerator fibres to the heart are derived from the upper thoracic nerves, and end similarly in the middle and lower cervical ganglia, gray fibres in the cervical cardiac nerve completing the connection."—(Gerrish's Anatomy, Page 18.)

Interscapular Region.—Therefore, we have an area extending from the second to the seventh dorsal, in which we must make careful examination for lesions affecting vaso-motor, trophic and secretory activity in the thoracic viscera, upper extremities, and structures of the head, face and neck. This explains to you why a treatment in the interscapular region has such far-reaching effects.

A Case Illustrating the Cilio-spinal Center.—As an illustration of the nerve connection between the cilio-spinal center, first, second and third dorsal and the eye, I wish to call your attention to a patient who was in the clinic of the P. S. O. two years before the time I write. There was extensive inflammation of the conjunctiva of the right eye, sight in that eye was almost gone on account of the opacity caused by the inflammation of the conjunctiva over the cornea. This condition was present for five years. The inflammation had traveled to the nasal duct, and as a result it was closed. The duct had been opened by the surgeon's knife long before we

saw the case. A close examination of the center likely to be irritated in such a condition disclosed the fact that the area between the first and third dorsal vertebrae was exceedingly sensitive, and, most interesting of all, pressure on this area caused intense pain in the inflamed eye, and caused the pupil to dilate. The muscles in the interscapular area were very much contracted. Treatment was given, and in proportion to the amount of relaxation gained in the interscapular area, the inflammation in the conjunctiva subsided. After one month's treatment, the patient could see to thread a needle, using only the formerly diseased eye. Pressure at the third dorsal spine still causes the patient to speak of a sense of pressure or swelling in the eye. (Two years have passed since this was written. The patient has continued to have perfect use of the eye.)

The following extract from "The Osteopath" in regard to this case, is of interest to us while considering the sympathetic nervous system: "It is not surprising that diseases of the eye should affect the sympathetic nerve, and that by that path the center known as the 'cilio-spinal.' But by what sensory path would the influence of pressure be carried to the eye? We know of none. From the first two dorsal nerves, which are identical with the cilio-spinal center, sympathetic fibres are distributed to the dilating muscle fibres of the iris, and when stimulated cause dilatation of the pupils. From the third dorsal nerve fibres are distributed which regulate the calibre of the blood vessels of the eye. Under the pressure, either set of these fibres may be affected. The first may be stimulated, dilating the muscles of the iris so as to press upon filaments of sensitive nerves; or, the pressure may inhibit the vaso-constrictor function of the other nerve, and by dilating the arterioles cause pressure upon the sensitive nerve; or, both causes may operate and thus induce the pain. The abundant supply of sensory nerves to the ciliary muscle, iris and cornea, from the nasal branch of the ophthalmic division of the fifth nerve and the short ciliary branches from the ciliary (lenticular or ophthalmic) ganglion makes it conceivable that any change of arterial pressure might affect these nerves to the

extent of causing pain. It seems reasonable to conclude that there was no inflammation, but congestion, and partial paralysis of the vaso-constrictor nerve."—(A. E. Brotherhood, D. O., D. Sc. O., in "The Osteopath," Vol. V., No. III.)

Effects of Treatment, First to Seventh Dorsal.—Treatment in the interscapular region, first to seventh vertebrae, may reasonably be expected to affect the heart beat, the nutritional circulation in the lungs, and the circulation in the upper extremities, head, neck and face.

The remainder of the dorsal area constitutes what is called the splanchnic region. Three splanchnic nerves are given off from this region to be distributed to the prevertebral plexuses in the abdominal cavity.

The Great Splanchnics.—The first is called the Great Splanchnic and takes origin from the sixth to the tenth dorsal nerves, and probably receives many filaments from the upper dorsal nerves. It is a large nerve trunk and contains many medullated nerves from the cerebro-spinal system. Its course is downward and inward, perforates the crus of the diaphragm and ends in the semilunar ganglion. Some fibres end in the renal and suprarenal plexuses.

Lesser Splanchnic.—The Lesser Splanchnic arises from the tenth and eleventh ganglia and their connecting cord. It also takes a downward and inward course, piercing the crus of the diaphragm, and ends in the Coeliac Plexus. It communicates with the Great Splanchnic, and sometimes sends fibres to the renal plexus.

Least Splanchnic.—The Least, or Renal Splanchnic, arises from the last thoracic ganglion and ends in the renal plexus. It sometimes communicates with the lesser splanchnic.

Functions.—First, vaso-constriction; second, viscero-inhibition. I mention merely those functions which have been well demonstrated by physiological experiments and osteopathic practice.

Theory.—The osteopath reasons as follows concerning this Splanchnic area: Since the Great Splanchnic ends in the semilunar ganglion, from this ganglion and plexuses

around it fibres are distributed to the blood vessels of the stomach, liver, spleen and intestines; therefore, we operate in the area between the fifth and tenth dorsal spines for vaso-motor effects on the above-mentioned viscera. Again, the great splanchnic sends viscero-inhibitory fibres to the muscular layers of the stomach and intestines; hence, we control excessive muscular activity in these viscera by removing obstructions to the normal inhibitory influence of these nerves. The Lesser Splanchnic has the same functions, but exercises its functions chiefly on that portion of the intestinal muscular layer comprised in the area supplied by the superior mesenteric artery; therefore, the tenth and eleventh dorsal area is a vaso-motor and motor-inhibitory center for a segment of the intestines. The renal splanchnics exert a vaso-constrictor influence on the blood vessels of the kidneys, and the osteopath secures vaso-motor effects on the blood vessels of the kidneys, and hence affects secretion by removing obstructions to the normal influence of this nerve.

The twelfth dorsal spine marks a renal center. These nerves contain sensory fibers which carry sensation from the prevertebral plexus in the abdomen to the spinal cord. Therefore, a disturbance in the viscera can reflex its painful sensations to the area of greater sensibility which is in close central connection with the seat of disturbance.

It should be borne in mind that the power of movement resides in the muscular wall of the intestine and is initiated by the Automatic Ganglia in its walls, which are excited by the pressure of food. We may state that the intestines possess an intrinsic nerve apparatus which initiates peristalsis, but the control of the movement after it is initiated is exercised by cerebro-spinal nerves. The pneumogastric nerve exercises a decided motor influence over the intestines. And, as previously stated, the great and lesser splanchnics are inhibitory nerves to the musculature of the intestines.

Lumbar Ganglia.—Four small ganglia, connected above and below by intercommunicating fibres, constitute the lumbar portion of the sympathetic ganglia. These ganglia are connected with the cerebro-spinal lumbar nerves by rami-

communicantes. The first and second ganglia are the only ones in this region receiving white rami-communicantes. The functions which we found were exercised in the lower dorsal area are continued into the lumbar ganglia as far as the second. These ganglia send fibres to the aortic plexus, the hypogastric plexus, and thence to the pelvic plexus. They also send branches, as in other regions, to the blood vessels supplying the bones and ligaments of the spinal column.

Since vaso-constrictor fibres do not enter the sympathetic ganglia below the second lumbar, we may reasonably expect to influence the circulation of the lower extremities by manipulations in this area.

The descending colon and rectum are supplied with viscero-inhibitory fibres from this area. Vaso-constrictor fibres are supplied to the blood vessels in the lower portion of the abdomen. The influence exerted by the lumbar sympathetics may be tabulated as follows:

1st: Viscero-inhibitory to descending colon and rectum.

2nd: Vaso-constrictor to lower abdominal blood vessels.

3rd: Vaso-constrictor to the blood vessels of the penis.

4th: Vaso-motor fibres to the blood vessels of the bladder.

5th: Vaso-motor fibres to the blood vessels of the uterus.

6th: Vaso-constrictor to the blood vessels of the pelvic viscera.

7th: Motor to vas deferens (male), round ligament (female).

8th: Vaso-constrictor to the blood vessels of the lower extremities.

Sacral Ganglia.—The pelvic portion of the sympathetic chain usually consists of four ganglia situated along the inner side of the sacral foramina, and communicates with the four upper sacral nerves. These ganglia are connected with each other, as in other regions. The two chains connect by the Ganglion Impar on the anterior surface of the coccyx.

Distribution.—The rami-efferentes are distributed to

the pelvic plexus; or a plexus on the middle sacral artery, and to vertebrae and ligaments in the sacral region.

"Through the pelvic plexus, the pelvic viscera are supplied with motor, vaso-motor and secretory fibres." (Gerrish's Anatomy, Page 648.)

The rami-communicantes in the sacral region are gray, hence, the influence of the cerebro-spinal system is carried down from the upper lumbar ganglia.

"Below the second lumbar vertebra they are also of the gray peripheral variety." ("Abdominal Brain," Page 31.)

In the sacral region the spinal nerves are distributed directly to the pelvic viscera; some fibres pass into the pelvic plexus, thence to the viscera.

The sacral region offers an area in which the osteopath can secure an influence on pelvic viscera without the extensive sympathetic connections encountered in other regions of the spine.

Function.—These sacral nerves are:

1st: Vaso-dilator to the vessels of the penis and vulva.
2nd: Motor fibres to the rectum.
3rd: Motor fibres to the bladder.
4th: Motor fibres to the uterus.

Cardiac Plexus.—The three great prevertebral plexuses must now engage our attention. The first one, the cardiac plexus, is situated at the base of the heart, and in the concavity of the arch of the aorta; this portion is called superficial, while the deep portion lies between the trachea and the aorta.

Position and Formation.—The cardiac plexus is formed by fibres from the pnuemogastric and cervical cardiac sympathetics. "It is very common to find upper cervical cardiac branches of the vagus and sympathetic united to form a common trunk. In other cases, the nerves branch and communicate with each other in a plexiform manner." (Morris's Anatomy.)

The cardiac nerves form the cervical sympathetic chain; all enter the cardiac plexus, but their distribution is variable. The superficial plexus receives the "left superior cardiac nerve

of the sympathetic and the left inferior cervical cardiac branch of the pneumogastric."—(Morris's Anatomy.)

The deep cardiac plexus "receives all the other cardiac nerves." From the superficial cardiac plexus branches pass to the plexus around the right coronary artery and pass to the left lung to join the anterior pulmonary plexus.

From the deep cardiac plexus branches are distributed to the anterior pulmonary plexus of both sides, the left coronary plexus, right auricle, superficial cardiac plexus, and right coronary plexus.

Pulmonary Plexus.—The anterior pulmonary plexus is formed by a branch of the pneumogastric and the sympathetic. It is situated on the anterior surface of the bronchi and the branches enter the lung on the bronchus.

The posterior pulmonary plexus is formed by the pneumogastric and fibres from the second, third and fourth thoracic ganglia of the sympathetic. Its branches enter the lung on the posterior aspect of the bronchus.

Physiology.—Physiological experiments have demonstrated that the pneumogastric is motor to the muscles of the bronchioles, sensory and trophic, while the sympathetics are vaso-motor and trophic. Therefore, the function of the lungs and heart can be affected by operating on the inter-scapular region.

Functions.—The functions of the thoracic plexus are:

1st: Cardiac augmentors, per sympathetics.

2nd: Cardiac inhibitor, per pneumogastric.

3rd: Vaso-constrictor to coronary arteries, per pneumogastric.

4th: Vaso-constrictor to bronchial arteries, per sympathetics, first to fifth dorsal.

5th: Sensory fibres to the pleura and lungs, per sympathetic, first to fifth dorsal.

6th: Sensory fibres to heart and pericardium, per sympathetic, second to fifth dorsal.

7th: Broncho-constrictor, per pneumogastric.

8th: Broncho-dilator, per pneumogastric.

9th: Sensory fibres to mucous lining of air passages, per pneumogastric.

Treatment.—A true inhibitory treatment would produce greatest effect on the heart, if administered over the middle and inferior cervical ganglia. The heart would be slowed. Such a treatment is rarely given, because nearly every case presents some physical lesion, which if removed, allows normal impulses to meet in the cardiac plexus and be re-organized for proper distribution.

Always bear in mind that a plexus is a re-organizing center for nervous impulses, and we can hope only to regulate the function of an organ by attempting to equalize the impulses reaching its controlling plexus. This equalizing process is not ordinarily secured by the administration of inhibition to a definite nerve trunk which ends in the plexus, but by removing a lesion,—usually bony or muscular—which is affecting the nerve fibre in the direction of increase or decrease of function.

The region between the scapulae is in close central connection with the lungs, pleura, heart and pericardium; hence, painful sensations originating in these organs may be referred to this area. The muscles in this area will contract reflexly from irritation of these organs, or from exposure of the skin over them to a change of temperature. Hence, in the first instance the contraction is a secondary lesion; in the latter, a primary one.

Pressure in this area practically causes relaxation of muscles, removes a lesion; but the patient experiences a cessation of pain, freer respiration, and less rapid action of the heart.

Results.—After administering inhibitory pressure, the osteopath realizes that the muscles under his fingers are softer than formerly; then he knows that he has actually changed the physiological condition of an important tissue.

Argument.—Coincident with the softening of the muscles, the heart beats slower; therefore, he has removed an irritant to the augmentor fibres of the heart; the respiration is deeper, therefore, a change has been secured in the activity

of the walls of the thorax, and in the circulation of blood in the bronchial and pulmonary blood vessels; the pain has decreased, therefore, the sensory nerves in the lung tissue are no longer irritated by hyperaemic pressure or toxic substances in the blood. This illustrates to you why the osteopath studies and treats the interscapular region so carefully.

Solar Plexus.—In the abdominal cavity we find the solar plexus, which on account of its great size and wonderful distribution, Byron Robinson calls the "Abdominal Brain."

Location and Formation.—It is placed in front of the aorta at its entrance into the abdomen, and surrounds the Coeliac Axis. It consists of two semilunar ganglia, which are placed on each side of the coeliac axis, and are connected by a large number of fibres which pass above and below the coeliac axis. From this circle of ganglia and nerves, fibres are given off which are joined by branches of the right pneumogastric, and by both small splanchnics. The great splanchnic ends in the semilunar ganglion.

Distribution.—The branches of distribution from the solar plexus are prolonged on the branches of the abdominal aorta as subsidiary plexuses, taking their names from the arteries they accompany, as splenic, gastric, hepatic, diaphragmatic, suprarenal and renal, superior mesenteric, inferior mesenteric, aortic and spermatic. The ultimate distribution of the branches of the solar plexus is to the muscular and secretory tissues of all the abdominal viscera, and to the muscular coat of the arteries supplying these viscera. This great plexus is the vaso-motor center for the abdominal viscera. "It is connected with almost every organ in the body, with a supremacy over visceral circulation, with a control over visceral secretion and nutrition, with a reflex influence over the heart that often leads to fainting, and may even lead to fatality."—"Abdominal Brain," Page 76.

Function.—We find that the great and the small splanchnics and right pneumogastric are the chief contributors to the solar plexus, and in order to get a clear idea of the functions of this plexus, we may tabulate them as follows:

1st: Viscero-motor to stomach, small intestines, as far as sigmoid flexure, per pneumogastric.

2nd: Sensory to stomach and small intestines, per pneumogastric.

"If the pneumogastric nerve be divided during full digestion in a living animal, in which a gastric fistula has been established, so that the interior of the stomach can be examined, the muscular contractions will be observed to cease instantly; the mucous membrane to become pale and flaccid; the secretion of the gastric juice to be arrested, and the organ to have become insensible. There can be no doubt, also, that stimulation of the pneumogastric nerves causes the stomach to contract, and that digestion may, to a certain extent, at least, be re-established by stimulation of the peripheral extremities of the divided nerves."—(Chapman' Phys., Page 680.)

3rd: Viscero-inhibitory, per splanchnics.

4th: Vaso-motor, per splanchnics.

5th: Sensory, per splanchnics.

6th: Sensory, per pneumogastric and splanchnics.

The fibres of the great and small splanchnics come from the sympathetic ganglia in the dorsal region, sixth to eleventh.

These ganglia may receive fibres from some of the upper dorsal.

Centers.—The facts just stated give us a foundation for osteopathic treatment to influence motion, sensation, secretion, and vaso-motion in the abdominal viscera. The area in the vertebral column which we may consider as containing centers for these various functions lies between the sixth and eleventh dorsal spines. The fibres from this region have a segmental distribution to the abdominal viscera; therefore, the stomach, liver, gall bladder, spleen and intestines, each have a limited portion of this area which is their special center; at least, painful sensations are reflexed from them to a definite point in the vertebral column between the sixth and eleventh dorsal spines. The enormous regulative influence which can be excited by an osteopathic treatment in this area is being demonstrated daily.

We have already mentioned the fact that the intestines will contract after being separated from the body, thereby, proving that the intrinsic power to cause movement lies in the nervous mechanism in the gut walls. Keep constantly in mind the regulative character of the impulses which enter the "abdominal brain" over the pneumogastric and splanchnic nerves.

The vaso-motor phenomena in this area have been discussed in another chapter.

Hypogastric Plexus—Location and Formation.—The great re-organizing center for the pelvic viscera is called the hypogastric plexus, which lies anterior to the fifth lumbar vertebra. It is formed by a continuation of fibres from the aortic plexus which are joined by fibres from the lumbar sympathetic ganglia. In front of the sacrum the plexus divides into two portions, which join the pelvic plexuses lying on each side of the rectum and bladder, in the male, and of the rectum, vagina and bladder in the female.

Pelvic Plexus.—These pelvic plexuses contain many small ganglia, and are joined by fibres from the upper sacral sympathetic ganglia, and by direct branches of the second, third and fourth sacral cerebro-spinal nerves.

Distribution.—The branches of these plexuses are distributed on the coats of the arteries to the pelvic viscera, and frequently enter the substance of the organ.

Subsidiary Plexuses.—According to the artery followed, we have subsidiary plexuses, called hemorrhoidal, visceral, prostatic, vaginal, and uterine.

Functions.—The functions of the pelvic plexus are as follows:

(1) Vaso-constrictor, (2) vaso-motor, (3) sensory, (4) viscero-inhibitor, per hypogastric plexus.

(5) Motor to rectum, vagina and bladder, (6) sensory to rectum, vagina and bladder, (7) vaso-dilator to sexual organs, erectile tissue, (8) viscero-constrictor to neck of uterus, per second, third and fourth sacral.

Summary.—With the arrangement and functions of

these nerves well in mind, we recognize two paths over which we can influence the pelvic viscera:

(1) Sensory influences may be reflexed through the hypogastric plexus, and thence to the second lumbar; or, they may pass over sacral nerves to the same point, second lumbar. In connection with disturbance of the pelvic viscera, pain may be reflexed on to the back of the sacrum, or to an area around the second lumbar. Disturbance of function in the uterus causes reflex sensitiveness at fourth and fifth lumbar.

(2) Vaso-constrictor influences come through hypogastric plexus from spinal nerves about second lumbar.

(3) Vaso-dilator influences come directly to the pelvic plexus from second and third sacral nerves; nervi erigentes.

(4) Viscero-motor influences chiefly from second, third and fourth sacral.

(5) Viscero-inhibitory influences, chiefly through hypogastric plexus, probably from upper lumbar spinal nerves.

We have therefore a vaso-constrictor center for pelvic viscera at second lumbar; a vaso-dilator and motor center at second and third sacral.

Automatic Visceral Ganglia.—The last portion of the sympathetic is but little known, and physiologists have refrained from speculating on it until more definite knowledge is obtained.

Byron Robinson mentions a number of "automatic visceral ganglia" situated in the walls of the hollow viscera. The fact that the heart, intestines, uterus, bladder and fallopian tubes will contract rhythmically in response to mechanical stimulation after all nerve connections are severed, seems to prove the existence of ganglia in the walls of these viscera which are capable of receiving sensation and sending out motor impulses.

Conclusions.—We will therefore conclude that the sympathetic system can act independently of the cerebro-spinal; that it receives sensation, and initiates motion; gives tone to the arteries, and controls secretion. We influence the functions of the sympathetic through its connection with the cerebro-spinal system.

CHAPTER VII.

HILTON'S LAW.

In the years 1860-61-62 a series of lectures was delivered by John Hilton, F. R. S., F. R. C. S., "On the Influence of Mechanical and Physiological Rest in the Treatment of Accidents and Surgical Diseases, and the Diagnostic Value of Pain." These lectures were afterward published in book form under the title of "Rest and Pain." This book is a medical classic and worthy of careful perusal by all students of medicine.

The careful observations and reasonings therefrom which are reported in "Rest and Pain" explain many of the phenomena noted in osteopathic practice. We desire to give all due honor to this man who was so far in advance of his time.

We shall quote a few paragraphs from "Rest and Pain" which have a direct bearing on osteopathic methods of diagnosis and therapeutics.

The Law Stated.—After careful study of the distribution of nerves throughout the body, Hilton sums up his observations in a terse sentence which we choose to call a law. *"The same trunks of nerves whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertion of the same muscles, and the interior of the joint receives its nerves from the same source."*

Hilton further states that *"Every fascia of the body has a muscle attached to it, and that every fascia throughout the body must be considered as a muscle."*

Methods of Studying Anatomy.—These statements

lead us to a closer study of each joint and its controlling muscles and governing nerve or nerves. We may study anatomy under artificial divisions such as Osteology, Syndesmology, Myology, etc., and still, after securing an accurate technical knowledge of details, we have nothing of practical value. It is in the correlation of these tissues with their interdependence quite fully understood that we have a working knowledge. With this thought of the influence of one tissue on another and the harmonious action secured by the comparatively varied distribution of the nerve trunks, we find a new and vital interest in anatomy.

This law is based upon the facts of anatomy and physiology, and makes our concrete knowledge of these subjects of constant practical value in both diagnosis and therapeutics. This law shows us the "why" of certain vital and mechanical manifestations, and teaches us practical methods of treatment.

Example of Hilton's Law.—An example of Hilton's law is the distribution of the sciatic nerve to the ankle. The muscles moving the joint, the synovial membrane and most of the skin over the joint are all innervated by it.

The Knee.—The knee has three nerves. Each one has a motor and sensory control. The extensor muscles and the skin over them is innervated by the anterior crural. The flexor muscles and the skin over them is innervated by the sciatic. The obturator, in addition to these nerves, furnishes sensory filaments to the synovial membrane. All the joints of the body may be examined in the light of this law. The same segment of the central nervous system which gives off a purely motor nerve trunk, gives off also a sensory nerve whose filaments are distributed over the same area. Thus it is sometimes necessary to go to the central nervous system to discover this association of motor and sensory distribution. In practice we always do this, because it is easier to work from the center of the areas of distribution.

The Object of Such a Distribution.—Hilton says: "The object of such a distribution of nerves to the muscular and articular structures of the joints, in accurate association, is to

insure mechanical and physiological consent between the external muscular, or moving force, and the vital endurance of the parts moved, namely, of the joints, thus securing in health a true balance of force and friction until deterioration occurs."

"Without this nervous association in the muscular and articular structures, there could be no intimation by the internal parts of their exhausted condition." "Again, through the medium of the *muscular and cutaneous* nervous association great security is given to the joint itself by those muscles being made aware of the point of contact of any extraneous force or violence. Their involuntary contraction instinctively makes the surrounding structures tense and rigid, and thus brings about an improved defence for the subjacent structures."

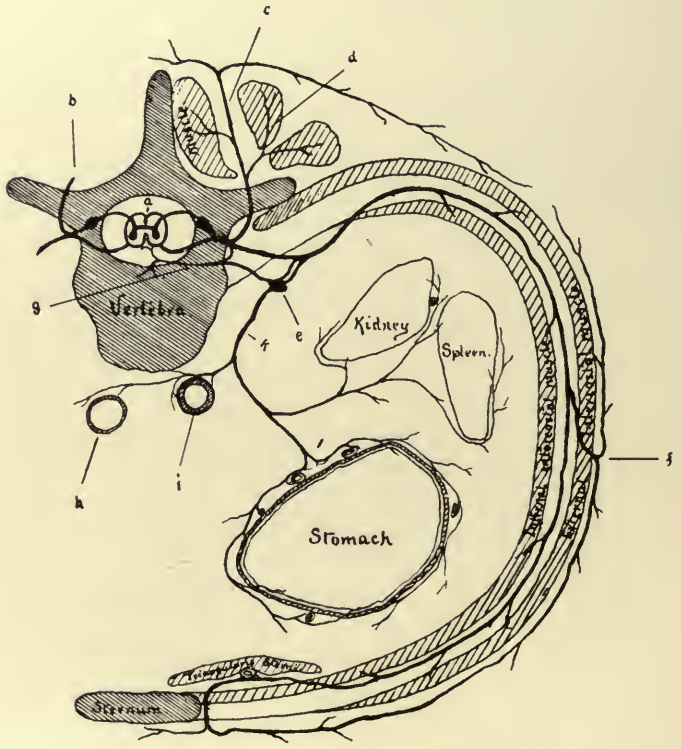
The Uniformity of the Law.—"This articular, muscular and cutaneous distribution of the nerves is, in my opinion, a uniform arrangement in every joint in the body. We may find numerous illustrations of the same method of distribution in other parts of the body, which have the same definite relations to each other, and in this respect present the same physiological and mechanical arrangement observable in joints. . . . . This same principle of arrangement, anatomically, physiologically, and pathologically considered, is to be observed with an equal degree of accuracy in the serous and in the mucous membrane. Thus considered, it presents a principle, which, if it has any application in practice, must be one certainly of large extent."

Precision of Nervous Distribution to Muscles.—"The great precision with which muscles are supplied by their nerves is worthy of remark; and is such that if we have before us a contracted muscle, we may be sure of the nerve which must be the medium, or the direct cause of it."

"In studying the supply of nerves to muscles over every part of the body, we find a great degree of precision, which marks one difference between their distribution and that of the arteries."

Indications for Use of Therapeutics.—"I should say in aid of other means, employ this cutaneous distribution of nerves as a road or means toward relieving pain and irritation

a. Spinal Cord
b. posterior primary division
c. Internal branch. (cutaneous)
d. External branch. (muscular)
e. Sympathetic ganglion.
f. Lateral cutaneous branch.
g. Recurrent branch
h. Vena Cava Inferior.
i. Aorta
k. Sympathetic branch.



Sectional Diagram of Human Body,

showing the wide range and intimate relations of

Nerve Distribution and Connections.

Fig. 30.—Drawn by J. E. Stuart, D. O.

in the joint. You thus quiet the muscles, prevent extreme friction, and reduce muscular pressure and spasm. Therapeutics may certainly reach the interior of this joint and its muscles through the medium of the nerves upon the surface of the skin, and so induce physiological rest to all the parts concerned in moving the joint. . . . . The advantage to be derived arises in this way: Sensibility of the filaments supplying the skin being reduced, that influence is propagated through the sensitive nerves, to the interior of the joint, and to the muscles moving a joint. This diminution of sensibility tends to give quietude or perfect rest to the interior of the joint, which is one of the most important elements towards the successful issue of the treatment of cases of this kind."

The Use of Hilton's Law in Physical Diagnosis.—Hilton's law is applicable in physical diagnosis. The osteopath makes constant use of the superficial expressions of nerve activity. After having learned the whole course, distribution and central connections of the nerve, we can judge rightly as to the structures involved, by noting the physiological conditions of all the structures innervated by a definite nerve trunk. Hilton applied his law entirely from the physiological side, i. e., he observed changes in the relations of joint structures, but considered the deformity as due to excessive physiological action of the muscles in their effort to secure rest for the joint surfaces. This is largely true, but he did not question how the process was initiated. The osteopath seeks a point of stimulus to the nerves controlling a joint or other structure, believing that it is of little value to anaesthetize nerve endings and give rest so long as this stimulus is allowed to arouse impulses in the nerve fibres.

Comparison of Methods.—To compare methods of using Hilton's Law, we will note one of his cases, and a similar one treated osteopathically. In Chapter VIII of "Rest and Pain" he describes a case of inflammation of the shoulder joint, and mentions that the joint is fixed in a position of rest as a result of the association of nerves to the synovial membrane, the muscles of the joint and the skin over the joint. Anaesthesia releases the fixedness of the joint, because the

muscles do not contract after the sensory impulses are deadened by the anaesthetic. He says "Therapeutics may certainly reach the interior of this joint and its muscles through the medium of the nerves upon the surface of the skin, and so induce physiological rest to all the parts concerned in moving the joint. I mean to say that these nerves upon the surface of the skin being in direct association with the interior of the joint itself, we may reduce the muscular spasm as well as the sensibility of the interior portion of the joint, by applying our anaesthetics with accuracy and with sufficient intensity upon the exterior of the deltoid muscle, over the distribution of these sensitive filaments. The thought will occur to you at once that there is nothing very remarkable in this opinion, and that is quite true. The embrocations, however, which would ordinarily be suggested for this purpose, are not of a character sufficiently potent to alleviate the pain of the patient, and are, I believe, seldom employed with a definite idea in the mind of the prescriber. I would suggest that we should employ our fomentations strongly medicated with bella-donna, with opium or with hemlock, instead of using mere fomentation of hot water. Some will say, 'Oh, hot water is quite as good;' but I can assure you practically that it is not so."

You will note that he makes use of the cutaneous reflexes to affect the interior of the joint.

A recent case, corresponding we believe, was treated osteopathically with marked success. The inflammation in the shoulder joint was not traumatic in origin nor did it appear to be rheumatic in character. Hot fomentations would give great relief, but did not give sufficient rest to the joint to permit of a cure. The fear was entertained that longer rest of the articulation would result in adhesion and loss of function in the joint. Since the circumflex nerve appeared to be the one involved, a careful examination was made of the articulations between the sixth and seventh cervical vertebrae. The circumflex nerve is made up largely of fibres from the sixth cervical nerve trunk. Tension and tenderness, together with slight rotation of the sixth cervical were noted at this point. The osteopath, instead of working over the area of distribution of

the circumflex, centered his work upon this articulation to bring about right relations between the sixth and seventh cervical vertebrae. Tension and irritation were removed. The circumflex nerve ceased to manifest any undue irritation. The osteopath almost invariably works from the center to periphery instead of the reverse.

Herpes Zoster.—An example of the osteopath's use, or rather recognition of Hilton's law: A case of Herpes Zoster located along the course of the left fifth intercostal nerve was given a grave prognosis by a homeopathic physician. The patient visited an osteopath immediately, hoping that some relief might be found for the intolerable pain. The eruption extended from the spine to the median line in front, forming a band about one inch wide. The fifth rib was found rotated downward, thus lessening the fifth intercostal space and pressing on the nerve at some point in its course. This rib was raised, even though the osteopath's fingers rested directly upon the eruption, in order to force the rib upward. The result was most gratifying. Pain decreased almost immediately, and there was a rapid change in the appearance of the eruption, the firey red giving place to a paler color. Those papules which were just forming subsided, and those which had formed vesicles began immediately to scab.

The Distribution of an Intercostal Nerve.—The distribution of an intercostal nerve is to the pleura, intercostal muscles and skin over these muscles thus corresponding to the distribution of nerve trunks to the synovial membrane of a joint, the muscles moving the joint and the skin covering the joint.

The patient could not stand erect, lifting the arm caused increase of pain, likewise inspiration was lessened because it caused pain. Hilton would say that these movements were curtailed to give physiological rest. From the osteopathic standpoint, they are reflexes which are not reparative in character, hence must be eliminated. Every movement which tended to separate the fifth and sixth ribs caused pain, hence the patient refrained from making them. The osteopath separated these ribs, even though the process of doing so caused pain. The structural defect causing the irritation was removed.

Some of the Evil Results of Rest.—If we are to give rest to structures in which pain is located, we will help to fill the world with stiff joints and serous adhesions, to say nothing of the far reaching after effects of these structural defects upon the functional activity of the nervous system.

Hilton's law may be called an anatomical law; there do not appear to be any exceptions to it, especially when supplemented by his statement that "every fascia of the body has a muscle attached to it, and every fascia throughout the body must be considered as the insertion of a muscle." This carries the influence of motor nerves to points covered by their sensory companions.

Head's Law.—Another law, or in this case a comprehensive statement, has been made by Head in his work on the "Brain." This is a statement of physiological transference of pain from its point of origin to a point of conscious sensation. This *physiological law* is stated as follows: "When a painful stimulus is applied to a part of low sensibility in close central connection with a part of much higher sensibility, the pain produced is felt in the part of higher sensibility rather than in the part of lower sensibility to which the stimulus was applied."

Application of the Law.—This physiological law can be applied in two ways. First, we may consider the relative sensibility of different portions of a nerve trunk. If a stimulus is applied to a nerve trunk at some point in its course between its origin and distribution, the pain caused by the stimulus will be felt in the area of distribution of the fibres of this nerve trunk rather than at the point where the stimulus is applied. The skin, mucous or serous membrane and muscle in which sensory nerves end are areas of high sensibility compared with the trunk of the nerve. The brain is conscious of only the areas of distribution of the sensory nerves, hence stimuli applied at the points of low sensibility are referred to the areas of high sensibility. Thus all lesions causing pressure upon nerve trunks cause pain, contraction, or perversion of secretion in the areas of distribution. The patient is not thoroughly conscious of any location but the area of distribution which is an area of high sensibility.

The cases described under Hilton's law are applicable here. In the case of inflamed shoulder joint the patient was not conscious of the irritation at the spinal column,—the rotated vertebra,—this was an area of low sensibility in the course of the nerve trunk. The brain attributed all the trouble to the terminations of the nerves in the tissues of the joint. All of the reflexes acted accordingly.

The second application of this law is to the relative intensity of areas of high sensibility. The areas in which sensory nerves end are all areas of high sensibility, but some are higher than others. We note in practice that sometimes a nerve trunk which supplies several structures will manifest pain in a portion of its area of distribution which is not the part in which the irritation is located. For example, the sensory portion of the obturator nerve is disturbed to the hip joint and skin on the inner side of the knee. The skin seems to be an area of higher sensibility than the interior of the hip joint, because in disease of the hip joint the patient frequently complains of pain in the cutaneous area rather than in the joint where the actual disease is located.

The Viscera.—The viscera are normally non-sensitive, i. e., we are not conscious of possessing viscera. The pressure of food in the stomach and the beat of the heart make no impression on our consciousness; and so it is with all parts of the body governed by sympathetic nerves. The viscera are areas of low sensibility, not low irritability, for they are richly supplied with sensory nerves, upon the stimulation of which active functioning depends. The response to stimuli of sensory nerves in viscera is rapid, but normally this response takes place entirely outside of our consciousness, the impression is not recognized as coming from the viscera, but from a remote area of high sensibility in close central connection with the less sensitive area. As an example, pain is felt in the right shoulder, as a result of hyperaemia of the liver. The pressure upon sensory nerves in the liver does not cause pain in the liver, but refers it to a more sensitive area—the skin and muscles of the right shoulder.

Chronic inflammation of the stomach may cause no con-

sciousness of pain in that organ, but may cause intense aching in the mid-dorsal region.

Nerves of Conscious Sensation.—Cerebro-spinal nerves are nerves of consciousness, and seem to have the duty of registering on the sensorium of our brains not only their own impressions, but the impressions derived from that part of the sympathetic system in closest central connection with them.

A close study of the segmental distribution of spinal nerves and their connection with the sympathetic system by the rami-communicantes will make Head's law of practical value in osteopathic diagnosis and therapeutics.

CHAPTER VIII.

LESIONS.

Definition.—We have now laid a foundation for the analysis of those structural changes which we designate as lesions. The word lesion is used by Osteopaths to designate something more than, "an injury, hurt or wound in any part of the body." (Gould.) Any structural change which affects the functional activity of any tissue is called a lesion. There may be structural changes which are very evident to palpation but do not affect functional activity and therefore are not lesions. A lesion is not only a structural change but such a change as influences function detrimentally. Fig. 41 illustrates a structural change without detrimental influence on function, while Fig. 42 illustrates a true lesion. The pressure of these structural lesions exerted on the media of communication and exchange, nerves and blood-vessels, is believed to be the chief element active in pro-

ducing and maintaining functional disorders. This is the central principle of osteopathic practice.

Lesions may be present in any tissue, but their existence is most easily recognized in bone, ligament and muscle. Dislocations and subluxations of bones, thickened ligaments and contracted muscles constitute the usual varieties of lesions. A true lesion is usually palpable; the functional disturbance is related anatomically and physiologically; there is hyperaesthesia at the palpable area.

These three conditions constitute the characteristics of the lesion as it is designated by the osteopath. Its palpability may vary between very wide limits; the anatomical and physiological association between the location of the structural change and functional derangement may be direct or indirect; the hyperaesthesia distinct or indistinct, still, the diagnostician is justified in centering attention upon the lesion if a reasonable amount of association can be detected.

History.—Osteopaths are not the first or only physicians who have used the spine as a means of diagnosis as well as an area upon which to concentrate therapeutic methods. It is interesting and instrucive to note the steps in the development of the knowledge of spinal conditions and of the indications of remote functional disturbances which are registered there.

Subjective symptoms precede any attempt to discover objective evidences of disease. It was early noted by physicians that patients could not be relied upon to interpret their own symptoms. This led to efforts to discover symptoms which were independent of the patients' imperfect perceptions.

Palpation would naturally be used at the areas complained of by the patient. Since the brain takes cognizance of only the peripheral areas of distribution of sensory nerves instead of the whole course of the nerve fibres, the
6 physician might still be misled in applying palpation, because he would be largely governed by the patient's sensory

impressions. Palpation made with reference to a realizing sense of the distribution and function of the nervous system, becomes a more satisfactory means of diagnosis. As the knowledge of the nervous system increased, attention was called more and more to the spinal column, on account of its relations to the great nervous mass within it. Palpation of the spinal column demonstrated the existence of sensitive areas, associated with visceral or other disorders; therefore, hyperaesthetic areas are the first diagnostic points mentioned in medical literature, in regard to the spinal lesion. Such hyperaesthetic areas were considered as evidence of spinal irritation; that is, irritation of the spinal cord. The first reference to spinal irritation which I have found, is contained in a monograph entitled "A Treatise on Neuralgic Diseases, Dependent on Irritation of the Spinal Marrow and Ganglia of the Symphetic Nerve," by Thomas Pridgin Teale—1834. He quotes a letter from Mr. R. P. Player to the editor of the Quarterly Journal of Science, "On Irritation of the Spinal Nerves," dated December 10th., 1821, as follows: "I take the liberty to submit to your notice a pathological fact, which has not, to the best of my knowledge, been generally remarked and attention to which, so far as my own experience goes, promises some diminution of those difficulties with which the healing art has to contend. Most medical practitioners who have attended to the subject of Spinal disease, must have observed that its symptoms frequently resemble various and dissimilar maladies and that commonly every function of every organ is impaired whose nerves originate near the seat of the disorder. The occurrence of pain in distant parts forcibly attracted my attention and induced frequent examinations of the spinal column; and after some years' attention, I considered myself enabled to state, that in a great number of diseases, morbid symptoms may be discovered about the origins of the nerves which proceed to the affected parts, or of the spinal branches which unite them; and that if the spine be examined, more or

less pain will commonly be felt by the patient on the application of pressure about or between those vertebrae from which such nerves emerge.

"This spinal affliction may, perhaps, be considered as the consequence of diseases, but of its existence at their commencement any one may satisfy himself; and this circumstance, combined with the success which has attended the employment of topical applications to the tender parts about the vertebrae, appears to indicate that the cause may exist there. Prejudice sometimes operates against ideas of connection so remote; but in many instances patients are surprised at the discovery of tenderness in a part, of whose implication and disease they had not the least suspicion."

Dr. Teale brings to his aid in the exposition of his subject some interesting corroboratory observations made by others and recorded in the medical literature of that period. He quotes Dr. Darwell in an interesting paragraph which is a faint distant undercurrent of Dr. A. T. Still's oft repeated statement concerning the interaction of nerves and the blood stream. The passage is as follows, "If however, the nervous system is more or less connected with every function of the animal body; if the circulation of the blood, the phenomena of the respiration and the operation of intellect, cannot be carried on without its intervention, the manner in which it is disregarded can not but be a most important defect. It has perhaps in great measure arisen from always contemplating the brain as acted upon by the circulation and never reversing the order of review."

One of the best expressed concepts of the nervous system I have read is Dr. Teale's introduction to his monograph. It is the concept which is being more clearly taught in osteopathic colleges than in those of other schools of medicine: "The term Neuralgia which was originally employed to designate certain affections of nerves attended with severe pain has of late with great propriety been extended from its original and literal signification, to many other morbid affections of nerves, which are not character-

ized by pain, but by some other perverted state of their functions.

"Neuralgia includes within its range a great variety of diseases, presenting an endless diversity both in their symptoms and in the parts where they are seated. That such variety should exist, ceases to excite surprise, when we consider how varied are the functions of the different nerves, and how diversified the tissues and organs to which they are distributed.

"To the attentive observer of disease, neuralgic affections, under the more extended signification, must repeatedly present themselves. The skin for instance may be the seat of every degree of exalted or diminished sensibility, from the slightest uneasiness to the most acute suffering and from the most trivial diminution of sensibility to the complete obliteration of feeling—symptoms not dependent upon disease affecting the different tissues of the part but solely referable to a morbid condition of the sentient nerves. The voluntary muscles may in like manner indicate in a variety of ways a morbid condition of the nerves with which they are supplied. They may be affected with weakness, spasms, tremors, or a variety of other disordered states included within the two extremes of convulsion and paralysis. The involuntary muscles may have the harmony of their actions interrupted from a morbid condition of their nerves; the heart may be affected with palpitation; the vermicular motion of the stomach or the peristaltic action of the intestines may be subject to irregularity. The sensibility of the internal organs may likewise be affected, the heart, the stomach, the intestines, being the seat of pain, referable to their nerves, and independent of inflammation, or any alteration of structure. The secretions may also undergo alterations, both in quantity and quality, from a perverted agency of the nerves upon which they depend. Such is a very imperfect recital of the various morbid affections which may be included under the term Neuralgia, and so frequent is their occurrence, that they must be familiar to every practitioner. They are, however, often perplex-

ing in their treatment and not unfrequently exhaust the patience of the afflicted sufferer, and also of the medical attendant.

"The difficulty and embarrassment which have attended the diagnosis and treatment of these affections, I am inclined to believe, has principally arisen from mistaken views of their pathology. They have too often been regarded as actual diseases of those nervous filaments which are the immediate seat of the neuralgia instead of being considered as symptomatic of disease in the larger nervous masses from which those filaments are derived; hence the treatment has too frequently been ineffectually applied to the seat of neuralgia; instead of being directed to the more remote and less obvious seat of disease.

"It is now pretty generally admitted as a pathological axiom, that disease of the larger nervous masses, as the brain and spinal marrow, is not so much evinced by phenomena in the immediate seat of disease, as in those more remote parts to which the nerves arising from the diseased portion are distributed. In the more severe forms of disease, this principle is readily admitted and recognized. When for instance one half of the body shall have lost its sensibility and the corresponding muscles their power of action, the skin and the muscle are not regarded as the seat of disease, but the brain is immediately referred to. In the slightest forms of disease of the brain and spinal marrow, such as do not completely obliterate but merely impair or pervert the functions of the nerves—such as do not paralyze the sentient and muscular powers of the part, but produce weakness, tremors, spasms, etc., in the muscular system, and numbness and prickings, pains and other morbid feelings in the nerves of sensation, this important principle, which as strictly obtains as in the former instance, is too often entirely overlooked; and a numerous class of complaints of very frequent occurrence, are regarded as nervous or spasmodic diseases of the part affected, instead of being considered as actual diseases of that portion of

the brain and spinal marrow from which the nerves of the part are derived.

"The same pathological principle is, I believe equally applicable to the sympathetic system of nerves; although it may be difficult to establish this opinion by actual experiment, yet I think it may be rested upon a well grounded analogy, which will justify us in regarding the nervous masses of the ganglionic system as bearing the same relation to the nerves derived from them, as the large nervous masses of the cerebro-spinal system bear to their respective nerves. Hence many nervous affections of the viscera ought not be considered as diseases of the viscera themselves but as symptomatic of disease in those particular ganglia whence their nerves are derived.

"Influenced by such considerations, I have for a few years been in the habit of treating many of these nervous affections as diseases of some portion of the spinal marrow or ganglia; and have been still further confirmed in my opinion by the frequent and almost uniform coexistence of tenderness on pressing some portion of the vertebral column and the circumstances of the tender portion of the spine being in a particular situation where the nerves of the affected part originate.

"The symptoms of spinal irritation consist in an infinite variety of morbid functions of the nerves of sensation and volition which have their origin in the spinal marrow, and the parts in which these morbid functions are exhibited, of course, bear reference to the distribution of the spinal nerves.

"The morbid states of sensation include every variety, from the slightest deviation from the healthy sensibility of any part, to the most painful neuralgic affections on the one hand; and to complete numbness or loss of feeling on the other; including pains which may be fixed or fugitive or darting in the direction of the nerve, pricking and tingling sensations, a sense of creeping in the skin, of cold water trickling over it, and numerous other states of perverted sensation of which words are inadequate to convey a

description. In the muscular system we find weakness or loss of power, tremors, spasms or cramps and sometimes a tendency to rigidity.

"These symptoms sometimes exist in so slight a degree that the patient considers them unworthy of notice, and only admits their existence when particular inquiry is made respecting them; the only complaint which he makes being of an unaccountable sense of weakness and inability of exertion. In other cases the tremors have excited alarm; sometimes the neuralgic pains in the scalp or the fixed pain in the muscles, particularly when it occurs in the intercostal muscles, have suggested the idea of serious disease in the brain or in the lungs; and when the pain is seated in the muscles of the abdomen, a fear that some organic disease of the abdominal viscera has taken place harrasses the mind of the patient. The muscular weakness in some cases tending to paralysis often suggests the fear of apoplexy or paralysis from cerebral disease.

"The affection is often of very protracted duration, undergoing alternate variations from the sanative powers of the constitution and the different existing causes of disease. There are many individuals in whom the complaint has existed, in varying degrees of intensity for a series of years, without its real nature having been suspected; the patients and their medical attendants having regarded it throughout as a rheumatic or a nervous affection.

"In this complaint tenderness in the portion of the vertebral column which corresponds to the origin of the affected nerves, is generally in a striking and unequivocal manner evinced by pressure. In some instances the tenderness is so great that even slight pressure can scarcely be borne, and will often cause pain to strike from the spine to the seat of spasm or neuralgia.

"This affection of the spinal marrow occasionally exists throughout its whole extent; more frequently, however, it is confined to some particular portion, and occasionally is seated in different and remote portions at the

same time; the particular symptoms and tenderness on pressure indicating the affected part.

"The symptoms of course vary considerably, according to the particular part of the spine which is affected, and bear reference to the distribution of the different spinal nerves.

"When the upper cervical portion of the spinal marrow is diseased, we frequently find neuralgic affections of the scalp; the pain strikes in various directions over the posterior and lateral parts of the head; sometimes the twigs in the neighborhood of the ear, sometimes those which ascend over the occiput to the superior part of the scalp, are more particularly the seat of the complaint; the nervous twigs distributed to the integuments of the neck are occasionally affected, the pain darting across the neck to the edge of the lower jaw, and sometimes encroaching a little upon the face. These neuralgic diseases frequently assume an intermittent form, the paroxysms generally occuring in the evening. A stiff neck or impaired action of the muscles moving the head frequently attend the affection of the upper cervical portion of the spinal marrow; and occasionally the voice is completely lost, or suffers alteration, and the act of speaking is attended with pain or difficulty.

"Irritation of the lower cervical portion of the spinal marrow gives rise to a morbid state of the nerves of the upper extremities, shoulders, and integuments at the upper part of the thorax. Pains are felt in various parts of the arm, shoulder, and breast; sometimes the pain takes the course of the anterior thoracic branches of the brachial plexus, occasionally the pain is fixed at some point near the clavicle, scapula or shoulder joint at the insertion of the deltoid, or near the elbow or shoots along the course of some of the cutaneous nerves. Frequently one or both of the mammae become exquisitely sensible and painful on pressure, and some degree of swelling occasionally takes place in the breast, attended with a knotty and irregular feeling, when the neuralgic pains have existed a considerable time in that part, prickling and numbness, tingling

and creeping sensations are often felt in the upper extremities; and also a sensation of cold water trickling over the surface. On rubbing the hands over the part affected a soreness is frequently felt, which is described as not merely situated in the integuments but also in the more deep seated parts. In the muscular system are observed most frequently a weakness of the upper extremities sometimes referred particularly to the wrists, tremors and unsteadiness of the hands; also cramps and spasms of various degrees of intensity. Occasionally there is an inability to perform complete extension of the elbows, the arm appearing restrained by the tendon of the biceps; pain and tightness being produced in this part when extension is attempted beyond a certain point. As far as I have observed, the pain and other morbid feelings in the upper extremities and chest are felt more frequently and more severely on the left than on the right side.

"Females of sedentary habits appear particularly subject to these affections of the upper extremities, and it is not uncommon for them to complain of being scarcely able to feel the needle when it is held in their fingers, and that their needles and work frequently drop from their hands.

"When the upper dorsal portion is affected, in addition to various morbid sensations similar to those in the extremities, there is often a fixed pain in some part of the intercostal muscles, to which the name pleurodynia has been assigned; and when this pain has existed a long time, there is tenderness on pressing the part. When the lower dorsal half of the spinal marrow is the seat of irritation, or subacute inflammation, the pleurodynia, when it exists, is felt in the lower intercostal muscles; frequently there is also a sensation of a cord tied round the waist; and oppressive sense of tightness across the epigastrium and lower sternal region; and soreness along the cartilages of the lower ribs or in the course of insertion of the diaphragm. Various pains, fixed and fugitive, are also felt in the parietes of the abdomen, throughout any part of the abdominal and lumbar muscles; the pain is frequently

fixed in some portion of the rectus muscle and not infrequently in the oblique muscle or transversalis, a little above the crest of the ilium, particularly when the origin of two or three of the lowest dorsal nerves is diseased.

"The affection of the lumbar and sacral portion of the spinal cord often produces a sensation of soreness in the scrotum and neighboring integuments; and the lower extremities become the seat of various morbid sensations, spasms, tremors, etc., for the most part resembling those which have been described as occurring in the upper limbs. The patients also complain of a sense of insecurity or instability in walking; their knees totter, and feel scarcely able to support the weight of the body.

"In some cases very considerable relief is found from recumbency, the pain frequently being diminished as soon as the patient retires to bed, independently of any paroxysmal remission.

"This irritation or subacute inflammatory state of the spinal marrow is not necessarily connected with any deformity of the spine, or disease in the vertebrae. It may co-exist with these as well as with any other diseases, but it so repeatedly occurs without them that they can not be regarded as dependent upon each other. Where, however, inflammation and ulceration of the vertebrae or intervertebral cartilages exist, it is probable they may predispose to, and in some instances, act as an exciting cause of an inflammatory state of the nervous structures which they contain; for we not unfrequently find inflammatory affections of the vertebrae in conjunction with symptoms of irritation of the spinal marrow. But these two affections, although co-existing, bear no regular relations to each other; and during the progress of the vertebral disease the affection of the nervous structures is subject to great changes and fluctuations. The local remedies employed for arresting the disease in the bone often alleviate the affection of the spinal marrow at the very commencement of the treatment, long before the vertebral disease is suspended; but as the neighboring inflammation in the bones appears to

predispose or excite the nervous mass which they contain to disease, relapses of the nervous affections are repeatedly occurring during the whole course of the complaint.

"The affections of the spine, termed lateral curvature and excurvation, appear to have no necessary connection with the disease which I have been describing; and the proportion of cases in which they are found united is so small that lateral curvature can scarcely be considered even as predisposing to this disease. The most extreme degrees of deformity are frequently observed without any affection of the nerves; and when lateral curvature does occasionally co-exist, local antiflogistic treatment will often speedily remove the nervous symptoms while the curvature remains unrelieved. Hence there is an impropriety in considering these nervous symptoms as a result of the deformity and in explaining them upon the mechanical principal of pressure and stretching, to which the nerves are supposed to be subjected as they issue from the intervertebral foramina. If the pressure and stretching produced by the curvature were the cause of the nervous symptoms, they ought to continue as long as the deformity remains.

"**Treatment.**—When the different neuralgic symptoms which have been enumerated can be traced to this morbid state of some portion of the spinal marrow, the treatment that ought to be pursued is readily decided upon. Local depletion by leeches or cuping, and counter irritation by blisters to the affected portion of the spine, are the principal remedies. A great number of the cases will frequently yield to the single application of any of these means. Some cases which have even existed several months I have seen perfectly relieved by the single application of a blister to the spine, although the local pains have been ineffectually treated by a variety of remedies for a great length of time. A repetition of the local depletion and blistering is, however, often necessary after the lapse of a few days, and sometimes is required at intervals for a considerable length of time. In a few very obstinate cases issues or setons have been thought necessary; and where the disease has

been very unyielding, a mild mercurial course has appeared beneficial.

"When my attention was first directed to this subject, I considered recumbency a necessary part of the treatment; it is, for a moderate length of time, undoubtedly beneficial and frequently very much accelerates recovery, but subsequent observation has convinced me that it is by no means essential. I have seen several instances of the most severe forms of those complaints occurring in the poorer classes of society, where continued recumbency was impracticable, which have, nevertheless, yielded without difficulty to the other means of the treatment, whilst the individuals were pursuing their laborious avocations.

"These observations, however, are not intended to apply to those cases in which there is actual disease of the vertebrae.

"When there exists a tendency to relapse, I have thought it advantageous to continue the use of some stimulating liniment to the spine for a few weeks after the other means of treatment have been discontinued. A liniment consisting of one part spirits of turpentine and two of olive oil is what has generally been employed.

"The ganglia of the sympathetic nerves appear subject to a state of disease similar to that which has been described in the preceding chapter, as occurring in the spinal marrow.

"As the disease may be confined to one part of the spinal marrow, or may exist simultaneously in different portions, or may even pervade its whole extent, so the affection of ganglia may be confined to one of these nervous masses, may exist in several which are contiguous, or in ganglia remote from each other; and as there is reason to believe the whole chain may occasionally be affected.

"The disease of the ganglia is seldom found, except in conjunction with that of the corresponding portion of the spinal marrow, whereas the spinal marrow is often affected without the neighboring ganglia being under the influence of disease. Thus we frequently find symptoms

of disease in a portion of the spinal marrow without any evidence of its existence in the corresponding ganglia, frequently the symptoms of both combined, and occasionally, but rarely, symptoms referable to the ganglia without the spinal marrow being implicated.

"The principal symptoms resulting from irritation of the ganglia of the sympathetic are to be found in those organs which derive their nerves from this source. They consist of perverted functions of these organs, and are exemplified by a variety of phenomena. The involuntary muscles, deriving their power from the sympathetic, have their action altered as is evinced by spasms and irregularity in their contractions. The heart is seized with palpitations, the large vessels with inordinate pulsations; the muscular fibres connecting with the bronchial apparatus are thrown into spasms, constituting a genuine asthma independent of bronchial inflammation. The muscular fibres of the stomach and intestines become the seat of spasms and various other deviations from their natural operation. The sensibility of the organs, which derive their sentient power from the great sympathetic, is variously perverted, the nervous filaments being the seat of pain. The heart and lungs, for instance, are subject to morbid sensations bearing great analogy to those which have been designated "tic douloureaux" when occurring in the spinal nerves. The stomach and intestines are liable to similar neuralgia, to which the names gastrodynia and enterodynia have been applied. The kidneys, the bladder, and the uterus are liable to the same perverted state of their sensibility. The secretions also undergo alterations, products being formed, which in health have no existence. This is exemplified by the enormous secretions of air which sometimes occur in the stomach. Large quantities of clear transparent liquid are also secreted by this organ, constituting what is called pyrosis. The secretions of the stomach undergo variation in their quantities, rendering them unfit for digestive process. It is probable that the secretion of the liver also experiences some alteration in these

complaints. The urine is sometimes influenced, and I am inclined to suspect that some forms of diabetes partake of neuralgic character. Leucorrhoea is frequently a concomitant of these diseases, and ceases on their removal; but I am not prepared to say that it is ever symptomatic of them. Irregularities in the catamenia are often observed, the discharge often being generally in excess.

"The ganglia most liable to the disease are the middle and lower thoracic, from which the splanchnic nerves are derived, giving rise to various disorders of the stomach and digestive organs, which will hereafter be more fully discussed. Next in frequency is the affection of the cervical ganglia, producing painful and spasmodic states of the heart. The symptoms denoting disease of other ganglia, although occasionally met with are less frequent in their occurrence. Irritability of temper and depression of spirits often attend these complaints, particularly the stomach is the part which suffers.

"The disease of the ganglia, like that of the spinal marrow, is not necessarily connected with disease of the vertebra or distortion of the spine. It may co-exist with these complaints, and, when it does so, the symptoms proper to the ganglionic disease are often erroneously supposed to be produced by distortion or by disease of the vertebrae; they are, however, frequently relieved by treatment, whilst the disease of the bones remains uninfluenced by it, and the most extreme distortion of the spine or destruction of the vertebrae from inflammation may exist without there being any symptoms attributable to neuralgia of the sympathetic nerves.

"In conjunction with the symptoms denoting disease of the ganglia, tenderness to a greater or less degree may generally be found on pressing some part of the spine, and the tender portion invariably corresponds with the symptoms; or rather, the seat of tenderness is near the part occupied by the particular ganglia from which the nerves of the disordered organ are derived; for example, when the heart is affected the tenderness is found in some of the

cervical vertebrae, and when the stomach is the seat of complaint, it is in some of the middle or lower dorsal vertebrae.

"With respect to the treatment, I have but little to add to what has been said in the preceding chapter respecting the treatment of irritation of the spinal marrow. Leeches, cuping, blisters, etc., to the neighborhood of the affected ganglia constitute the essential part."

Muscular Contraction.—Following the observation of spinal tenderness came the noting of muscular tension accompanying it. As near as I can determine from perusing medical literature, muscular tension was not recognized until after the advent of Osteopathy. Since the attention of medical writers was called to the conditions of the spinal column called "lesions" there are frequent passages descriptive of these in medical literature. One of the best of these references is found in Boardman Reed's work on "Diseases of the Stomach and Intestines," and is as follows:

"Dr. John P. Arnold has recently called attention to a novel objective sign which may be recognized upon palpation over the sensitive regions along side of the spinal vertebrae, and sometimes in such regions which are not sensitive to pressure, though in all cases he maintains that the part of the body supplied by the vaso motor nerve fibres immerging in the corresponding intervertebral space will be found to present some abnormal condition. The peculiarity described by him is, in such cases, a somewhat doughy, and in chronic ones, a gristly, tense, cord-like feeling of the band of longitudinal muscular fibres which run up and down on either side of the spine. This abnormality is supposed by Arnold to be due to a congested or infiltrated condition of the muscle while the cord itself is anaemic, probably in chronic cases. Hammond believed the spinal cord to be anaemic in such cases. The findings obtained by a careful palpation over the spine should thus assist in directing our attention to the organ or part of the body which may be suspected of being diseased.

"You should make it a rule to examine carefully the spines of all chronic invalids by pressing deeply with the

finger tips (or with the thumbs, as Flint advised) close to the vertebrae and then exert gentle traction in a lateral direction outward from the spine on either side. The patient should be lying upon his right side while you palpate along the left side of the vertebrae, and should then change to his left side in order that you may palpate upon the right side of the latter so that the tissues may be in the utmost condition of relaxation practicable. In both cases you will find it best to stand in front of the patient and reach over his upper side to make palpation along the region of the upper side of the spinal column.

"In numerous patients, especially those suffering from digestive derangements, you will be likely while palpating in the way described to recognize in the longitudinal muscles running parallel and close to the spine the tense, cord-like sensation above mentioned. If, simultaneously with your recognition of such a condition the patient complains of sensitiveness in the same regions, the accuracy of your finding will be at once confirmed."

The use of these tense cord-like muscles as diagnostic evidences of disease has been a constant practice of Osteopaths from the beginning of Dr. Still's work. Judging from the quotation the true significance of these contractions has not been apprehended by the medical profession in general.

It is very evident that a contracted muscle is shorter and thicker than when relaxed, also that when contracted it exerts force to draw its extremities together. The ends of the muscle being attached to bones forming portions of a movable articulation, a change in the relation of the bone must follow. This change is called a subluxation and is described more in detail in the following chapter.

Having noted that sensitiveness and muscular contraction are well recognized conditions found along the spinal column, the question arises, are these merely objective symptoms of disease or are they to a large extent causative factors in the origin and maintenance of diseased conditions of the areas of peripheral distribution of spinal nerves? Are they causes or effects?

They have been noted almost exclusively as efficient causes of disease. Furthermore osteopathic therapeutics have been administered from that standpoint with marked success. This change in position and size of tissues is recognized as an obstruction to the movements of fluids, and therefore is a condition operating in the system to cause disease.

Classes of Lesions.—Lesions, according to osteopathic theory may be of two classes, i. e., first, change in size of tissues; second, change in position. Generally speaking, a change in size is far more difficult to overcome than a change in position; because the former is a result of more profound changes. Tissues may increase in size as the result of efforts to repair injury, e. g., the formation of callous in bone, or thickening of ligaments following a sprain.

Cause of Lesions.—The causes of lesions fall under two general divisions. First, violence; second, failure to react to environment.

In the first division, all the lesions are primary in character, i. e., the violence immediately changes the relations of structure, and this change becomes an obstruction to vital activity of the body fluids. If the lesion is not corrected by the recuperative power of the body itself or by outside efforts, the change in position is very apt to become complicated by a change in size. The injury results in thickening of the ligaments or other fibrous tissues.

The second division of lesions is a very large one. These lesions develop as an evidence of the failure of the organism to become perfectly adapted to its food, clothing, labor or general environment. They are, therefore, secondary in character and must be recognized as objective symptoms of one functional derangement, while at the same time they operate primarily to cause functional derangement elsewhere. Thus they may be removed by manipulation and cease to act as an active cause of functional change, but will return again so long as environmental forces are overwhelming.

The first division or primary lesion may result from sudden violence or from a force comparatively weak but long continued. In other words, a lesion may be developed immediately under great force or slowly as the result of great fatigue. An example of a lesion developing under fatigue is noted in the faulty positions assumed by the body following prolonged effort or in performing certain tasks.

The second division or secondary lesions may result from failure to react properly to changes of temperature. The temperature of the surrounding air may be the same at various times, but the character of the cothing may necessitate a greater effort at adaptation. There must be suddenness in the change of temperature or clothing in order to produce the lesion, i. e., the responsiveness of the tissues must be overtaxed. The first effect of failure of adaptation is the contraction of muscle and accompanying sensitiveness. The distortion of the bony structure is consequent on the contraction. Ordinarily, if the shock is not too great, the adaptive forces of the organism will exert sufficient power to correct the condition, but when the environment is not suitable the lesion may become permanent. Humidity or electrical conditions of the atmosphere may operate to produce these lesions.

We have noted that these lesions have been discovered coincident with visceral disorder. We may therefore safely assume that food which is too difficult of digestion, or the usual food taken during fatigue, may act chemically to produce spinal lesions. In this instance they are certainly objective symptoms of visceral disease, but as stated before they must be primary causes of other disorders. To remove such a lesion by manipulation is helpful to the organism, but the patient must know that dietetic indiscretions or eating when fatigued was the real starting point of the disease. Here is where dietetic and hygienic knowledge must be a portion of the physician's therapeutics. If the pointing out of structural changes as a result of functional disturbance due to indiscretions in eating and other appe-

tites, will lead patients to simpler living, the physician may feel that he has performed a duty more valuable to the patient than the removal of his secondary lesions. There can be no doubt but that the removal of a primary lesion due to violence is absolutely essential, but when we maintain that all lesions must be removed before function can right itself, we become absurd. Furthermore, if we contend that a structural lesion antedates all functional disturbances we make of life a series of accidents, instead of a force governed by fixed laws.

The question arises why does the muscular contraction persist after the proper changes in habits have been made? This question can not be answered at present. Scarcely one of us will voluntarily make the change in habits until forced to do so by failure of the body to respond to our demands. Many things of a sociological character are at work to compel people to labor after fatigue is evident, to eat, sleep, and dress unhygienically. Viewed from this standpoint, the practice of medicine is a problem in sociology.

The original irritation which causes the tension probably causes more or less congestion of blood. The congestion results in over-growth of tissue, which becomes a fixed condition maintaining the lesion, i. e., it is a portion of the lesion.

Diagnosis of Lesions.—We have considered three points concerning lesions—hyperaesthesia, muscular contraction, and subluxation. They have been considered in this order merely on account of historical reference. In osteopathic practice, they are reversed. We note first the structure, then the tension which accompanies the change in structure, then the hyperaesthesia.

Changes Due to Growth.—It is not uncommon to find changes from the usual forms of the bones. Sometimes these changes may be very deceptive, but when analyzed with reference to the existence of functional disorder in the area of their normal influence and the presence of hyperaesthesia, they will be recognized as morphological

changes due to natural causes. Lesions which might have been active at a former time are sometimes nonactive on account of laws of accommodation which are always active in the body. If the body has succeeded in recuperating from the effect of these lesions, it is unwise to disturb them. As an example of an accommodated lesion, we may mention the formation of a new socket for the head of the femur following dislocation.

There are variations in development all through the body, and each physician should strive to become acquainted with them.

Structure.—The first sign of a lesion is noted by palpation, i. e., the change in structure is felt. According to what we have just said, this is not sufficient evidence of the existence of an active lesion. It must be accompanied by other signs. First, try to eliminate the apparent existence of the lesion by having the patient "assume different positions." Second, note whether the bony land marks in that area vary from the normal. Third, note whether the lesion causes the patient to assume any special attitude. Fourth, test the amplitude of movement in the articulation to determine the changes in its extent. If there is perfect flexibility it is scarcely probable that a lesion exists, for an active lesion is quite inconceivable without tension. Fifth, feel of the soft parts of the joints, muscles and connective tissues. Note any swelling or change in temperature. Sixth, inspect the surface as to color and texture. Seventh, test sensibility by pressure as has been described heretofore.

Ordinarily an examination of the body for lesions consists in comprehensive palpation, which notes synchronously the existence of positional change, tension, temperature, swelling, and sensitiveness. The existence of tension is sufficient evidence of decrease of flexibility.

Correction of Lesion.—When violence is the cause of the lesion, it is necessary to correct structure directly. When the osseous lesion is the result of muscular tension due to reflex stimulation, methods differ according to the

view point of the physician. Some manipulate for direct reduction, others relax muscles, and thus remove the cause of the osseous lesion. The really comprehensive plan should take into account the cause of the tension which occasions the osseous lesion. Having done this, the physician may manipulate the lesion to secure direct reduction with the feeling that the problem has been undertaken wisely.

CHAPTER IX.

SUBLUXATIONS.

The word subluxation belongs most decidedly to osteopathic literature. No other system of therapeutics has taken any special notice of the effect of minor accidents on the osseous and muscular structure of the body. It may be said that the seed from which the osteopathic system of therapeutics grew had for its germ cell a subluxation.

Dr. Still tells us of his earnest thought and study of the skeleton of the human body. His mechanical brain could conceive of mechanical disorders in the body which must be treated mechanically in order to be corrected. Study and experience combined to fix this idea more firmly and vividly in his brain. We can now see the great and lasting value of his basic idea that perfect structure is requisite for perfect function; that there is no unused space in the body, hence a bone out of place must be occupying some other tissue's place; that impingement of bone or other structural tissue on blood vessels and nerves results in perversion of the normal function of these obstructed media of exchange and communication.

Definition.—The word subluxation was so new to the general medical profession that much ridicule was heaped upon the osteopaths because they advocated such a ridiculous theory as that "all diseases are caused by dislocation of bone." We

are not so sure but that this ridicule was to a large extent well merited by the osteopaths. The loose way in which the words luxation, dislocation and subluxation are used in some of our literature shows that they do not always cover a definite idea in the mind of the writer. They can not be used interchangeably. The word subluxation should be used to denote a definite pathological condition. Subluxation is defined as a partial dislocation in which the normal relations of the articulating surfaces are but slightly changed.

Da Costa describes subluxation of the shoulder, also of the head of the radius. For the latter condition he has collected eight different explanations. We have not been able to find the term used in reference to any other articulations. The osteopath uses the term to define certain inequalities in the arrangement of vertebrae and ribs. Perhaps we hear the term used in connection with the atlas more than with any other bone.

Diagnosis.—Subluxations allow considerable movement in the articulation, but to the trained hand there are evidences of malposition. Pain is developed when the complete normal movement is attempted by the operator. Digital pressure around the joint causes deep pain. There is usually a history of accident, exposure or visceral disorder.

Primary or Secondary Lesions.—From experience we know the frequency of very evident malpositions of vertebrae, commonly spoken of as subluxations, and as being true or primary lesions causing disordered function in the area of peripheral distribution of the nerves from that segment of the spinal cord.

Analysis.—In order to get at a true understanding of what subluxation is we must make a careful study of the structures which form a joint and their vital manifestations.

The bones of the skeleton are bound together by ligaments and muscles. The opposing surfaces of bones forming movable joints are covered with cartilage. The muscles execute and the ligaments or soft parts around a joint limit the motions of the articulation. All moveable articulations have their bony parts maintained in their normal relations either

by the form of the bones and cartilages attached to them or by the equal tension of all the controlling muscles. Enarthrodial joints have freest movements and yet are the least dependent on muscles for retention of their normal position. Air pressure and the form of the bones are responsible for the integrity of these joints. These joints are less frequently subluxated than those possessing more limited motion. Arthrodial joints depend upon the equal tension of their governing muscles to keep the opposed surfaces in their proper relations. Co-ordination of the muscular tension is usually so perfect that the joint surfaces are perfectly opposed to each other. The disturbance of this nicely balanced muscular tension results in the drawing of one or both bony surfaces away from their true relations; not entirely, but sufficiently to make it possible for the physician's fingers to note the change.

Occipito-atlantal Articulation.—The atlas is placed not only first in the vertebral column, but also first in importance to the osteopath on account of the great possibilities for slight displacement between it and the occiput. All the conditions are present which make a very moveable joint, and close at hand are important nerves and blood vessels whose slightest maladjustment causes instant disturbance at the very fountains of life.

No physical examination is considered complete without noting accurately the position of the atlas. There being no spinous process, all reckoning must be made from the transverse processes.

According to Gray's Anatomy: "The movements permitted in this joint are flexion and extension, which give rise to the ordinary forward and backward nodding of the head, besides slight lateral motion to one or the other side. * * * * The Recti Laterales are mainly concerned in the slight lateral movement. According to Cruveilhier there is a slight motion of rotation in the joint."

According to Gerrish: * * * "Some *lateral gliding* is also allowed, by which the outer edge of the condyle on the one side is depressed, and on the other is elevated in relation

to its socket. Or the movement may be *obliquely lateral,* one condyle advancing slightly at the same time that it is depressed toward the median line, while the opposite condyle takes the reverse position. This is the position of greatest stability, and is assumed in the most easy and natural attitudes. *Lateral* movements are restrained by the check ligaments and the lateral parts of the capsules. No true *rotation* is allowed."

The capsular ligaments are very loose, hence the strength of the joint lies in the anterior, posterior and lateral ligaments. There is no cartilaginous disk between the atlas and occiput, hence motion is limited only by the ligaments named.

If one should judge of the prevalence of dislocations of the atlas by the number of times such a condition is mentioned in osteopathic literature we would draw the conclusion that every one's atlas is dislocated. The term dislocation is a strong one, and ought not be used in connection with the atlas. Its dislocation would cause death instantly. Subluxation is the proper term to use. Subluxations can be readily diagnosed; the fact that they exist can not be doubted; all positions between the normal articulation and complete dislocation are possible. The complete dislocation of this bone from the occiput means death; intermediate positions, subluxations, mean both irritation of nerves direct, and both direct and indirect disturbances of circulation; direct disturbance by pressure exerted on arteries and veins, indirect disturbance by excitation of vaso motor nerves.

The Causes of Subluxation.—It is difficult to account for these subluxations of the atlas without bringing in the contraction of muscles. This seems to me to be the most prevalent cause of misplacement of the atlas. Even though we recognize the numberless jars, twists and strains of this articulation, still the resultant bad effects are maintained by the unequal contraction of opposing groups of muscles which is brought on by these accidents. Take, for instance, the various twists of the atlas found by osteopathic methods of physical diagnosis. Gray says: "The Recti Laterales are mainly concerned in the slight lateral movements." This is

the movement concerned in a lateral subluxation. The position in which we usually find the atlas is an oblique one, having the right transverse process hugging the angle of the jaw while the left is too close to the mastoid process. Gerrish describes this position as the *"obliquely lateral,"* a normal movement. We also consider it normal if it possesses the ability to slip back into a position having similar relations on both sides. It is a subluxation when it can not get out of that position without assistance. If there is free movement in the occipito-atlantal articulation, every change of the position of the head will change the relations in this joint. Our bodies are constructed so that when the bones forming a joint are moved to their fullest extent pressure is usually exerted on soft tissues around the joint. This is normal, but when these normal relations are retained too long and the bones do not resume their easy resting position the condition becomes abnormal; it is then a subluxated joint.

There is no articulation in the body whose bony parts are abnormally related when the extreme movement in the joint is made. We will except the sacro-iliac articulation, because it is not considered a moveable joint. The subluxation consists in the relation of the bony surfaces in a position other than that which they should hold during relaxation or equal tension of all the muscles. The normal position of the transverse processes of the atlas is pictured in Fig 31. The subluxations are pictured in Fig 32.

The normal relations of the atlas are illustrated by photographs of the skull and first cervical vertebra in Fig. 33. Fig 34 shows an oblique side view. In Fig. 35 the atlas is slightly twisted, so that the right transverse process is posterior. This rear view shows the distance between the left mastoid and left transverse process increased. The right transverse process is prominent. The same relations viewed from below are shown in Fig. 36. The right transverse process is slightly posterior to the mastoid.

Figs. 37 and 38 show side and lateral views of a twisted atlas. In preparing these bones for photographing, it has been borne in mind that the articulating surfaces must be

Fig. 31.—Normal surface marking of the transverse process of the Atlas.

kept in close apposition. The relations illustrated are normal to the articulation, but abnormal when retained in these positions after relaxation of opposing muscles.

If, as Cruveilhier says, there is a slight rotation in

Fig. 32.—Abnormal surface markings of the transverse process of the Atlas.

this joint—and osteopathic practice proves Cruveilhier's statement true—,then what muscle could by its persistent contraction cause this rotation to be maintained? The Rectus Capitis Anticus Minor is so placed as to cause this movement. It

Fig. 33.—Normal relations between the Atlas and Occipital bone.

Fig. 34.—Normal relations between the Atlas and Occipital bone.

arises from the anterior surface of the lateral mass and root of transverse process of the atlas and passes obliquely upward and inward. It is inserted into the basilar process of the occipital bone. This muscle has as its external relation the superior cervical ganglion of the sympathetic, and as a contracted muscle is thicker than an uncontracted one, pressure may be exerted on this ganglion which may also be irritated by the transverse process of the atlas being pulled toward it, thereby lessening its normal space in more than one direction.

Fig. 35.—Right transverse process of the Atlas too far posterior.

The reflexes originated by this irritation of the superior cervical ganglion or its connections may initiate changes in the caliber of the blood vessels of the brain, eyes or any other circulatory area under control of the ganglion.

The influence exerted directly on circulation by the subluxation of the atlas is probably most active where the vertebral arteries pass through the foramena in the transverse processes. It might be argued against this view that nature has not failed to provide a certain amount of elasticity in the artery and surrounding structures to meet just such a condition. Nature has certainly done this, but not with the idea

in view that any such exaggerated condition is to be maintained for any great length of time.

Subluxations of the atlas are found in connection with a great number of disturbed areas, but the pathological condition in each is the same. For instance, there is no difference between a hyperaemia in the nasal, pharyngeal or laryngeal mucosa and a congestion of the retina, except in location. We must not view retinitis as a distinct disease from laryngitis. If we should do so, we fix our attention on symp-

Fig. 36.—Right transverse process of the Atlas too far posterior.

toms and see a picture which conceals causes. When the superior cervical ganglion has its function of vaso-constriction inhibited by continued irritation, the work of maintaining vascular tone is passed along to peripherially placed ganglia. If the eyes are strained by over work, the resistance of their nerves is decreased. This, added to the weakened vaso-constrictor action of the superior cervical ganglion, allows congestion, a retinitis. Wearing high collars weakens the resistance of nerve endings in the skin of the neck. This, added to low power in the ganglionic station, leads to congestion in the pharynx or larynx. Treatment must be applied to the structures around the ganglion, and peripheral

nerve power increased by gradually exposing the skin to the atmosphere.

The Atlas and Axis.—The articulation between the atlas and axis is the most intricate in the whole spinal column, consisting of four distinct joints. Rotation takes place between these bones, but this motion is limited by the check ligaments. Dislocation of the odontoid process causes instant death by pressure on the lower part of the medulla oblongata.

The articulations between the articular processes of these

Fig. 37.—Twisted Atlas-rotation.

bones are arthrodial. The articulation between the odontoid process of the axis and anterior arch of the atlas holds the bones firmly together. Most of the rotation in the cervical region is in this joint. Although there is so much movement allowed by these articulations we seldom find the axis subluxated.

Unequal Development.—Deviation of the spine of the axis from the median line is a frequent condition, but in the majority of cases is its normal relation on account of uneven development.

Caries.—Hilton describes cases of disease of the artic-

ulation between the atlas and axis, showing how destruction of the transverse ligaments allows the head to tip forward, thereby causing the odontoid process to impale the medulla.

We may safely say that dislocation of the atlo-axial articulations is probably the rarest condition we will ever meet. Various degrees of rotation may be met with which are in the nature of subluxations due to muscular contractions.

Spontaneous Reduction.—Since the above paragraph was written, an article in the Medical Record, March third,

Fig. 38.—Twisted Atlas-rotation.

1900, has come under my observation. The article is entitled, "Spinal Fracture—Paraplegia." The author, Dr. Robert Abbe, exhibits a radiograph illustrating a case of dislocation of the neck. The dislocation is between the articular processes of the atlas and axis. The most interesting feature of the case is the spontaneous reduction of the dislocation while the patient was asleep. The author thinks that the relaxation of sleep and the restlessness of the patient combined to reduce it.

Cervical Vertebrae.—The remaining cervical vertebrae are occasionally forced from their proper relations by violence. Quite a number of cases are on record which show how great the disturbance is in such conditions. Those cases recorded in medical literature are complete dislocations, and hence can not be classed with subluxations such as are met with in osteopathic practice. In order for complete dislocation to take place, i. e., so that the articular processes are both locked, the intervertebral disks would have to be torn and would bring great pressure on the cord.

All grades of subluxation are found between cervical vertebrae. Where the violence has not been sufficient to cause locking of the articular processes, it has exaggerated the normal movement sufficiently to injure the ligaments or muscles, which therefore maintain the subluxated position.

We can not estimate the extent of the systemic effects of a lesion in the spine. What might appear to us to be a very slight lesion, might be the cause of a very profound nervous disorder. The position of the lesion is the chief means of estimating results.

To illustrate this point, we may mention the case of Mr. Norton Russell. A lesion of the sixth cervical vertebra was found. The vertebra was slightly twisted. Mr. Russell had not slept during one hundred nights and days without the use of sulphonol or morphine. The first osteopathic treatment applied to the sixth cervical vertebra made it difficult for him to keep awake until he reached his home, and then he fell into a profound sleep. There was a history of severe accident. Muscular contraction was very evident.

Fig 39 illustrates the appearance of the posterior surfaces of the cervical vertebrae, second to the seventh, when all the vertebrae are in normal position, i. e., articular surfaces evenly opposed to each other. The changing character of the spinous processes is readily noted. Nearly all of these processes are unevenly developed, showing that palpation of these prominent points can not help being unsatisfactory. The tubercles
7 on the back and outer surfaces of the inferior articular processes present a much more uniform development and they

can be easily palpated after one has become accustomed to the feel of the cervical muscles.

Fig 40 shows the third cervical subluxated to the right. The tubercle on the left inferior articular process is made more prominent. The muscles over this point will be found contracted.

Fig. 39.—Normal relations of the cervical vertebrae.

Fig. 40.—Third cervical vertebra subluxated to the right. The superior articular process of the fourth cervical is visible.

Dorsal Vertebrae.—When the spines of the dorsal vertebrae are palpated, the trained fingers may find individual spines which are not in line with those above and below, or that the spacings between the spines is not equal. These deviations from the normal are indicative of changed relations between the vertebrae.

The normal movements in the dorsal region are flexion, extension and rotation. The lesions in this region correspond with these movements.

False Lesions.—We must guard against being misled by the deviations which we find, especially lateral ones. Fig. 41 illustrates a decided lateral inclination of the third dorsal spinous process. Such a deflection from the median line would be noted by the unskilled touch of a layman. This deflection

has no diagnostic significance, unless there is pronounced sensitiveness around it, and then it is the hyperaesthesia and not the osseous formation that must be noted. A very skillful osteopathic diagnostician might be misled by this *lesion.* There does not appear to be any way to protect against a wrong interpretation in a case like this except the experience of the physician in weighing all the evidence.

Fig. 41.—Abnormal development of the spinous process of the third dorsal vertebra. A False Lesion.

Lateral Subluxation.—Fig. 42 illustrates a genuine lateral subluxation of a dorsal vertebra. The arrangement of the Rotatores Spinae accounts for such a lesion as this. They arise from the upper surfaces of the transverse processes and insert into the laminae above. The subluxated vertebra in this group is the fifth. The digitation of the Rotatores Spinae between the right transverse process and lamina of the seventh must contract in order to produce this condition. This digitation may respond to a severe visceral reflex and cause a subluxation of this character. Direct violence may cause it, also a cutaneous reflex iniated by temperature change in the atmosphere.

Muscular Contraction.—Muscles contract as a result of excessive straining or wrenching, or exposure to cold and of reflex irritation. If opposing muscles under all condi-

tions of temperature, mechanical and reflex irritation would continue to exert equal influence on a joint, then nothing but a complete dislocation would be possible. A moveable joint is enclosed in a synovial membrane which facilitates the rapid return to a normal position. All the mechanical conditions in and around a joint are conducive to the quick return to normal. It is the vital and not the mechanical principle which keeps up a condition of maladjustment. No inter-

Fig. 42.—Lateral subluxation of a dorsal vertebra.

mediate position is possible, there being no unevenness of surface to become locked, unless we take into consideration the vital activity as manifested in a contracted muscle.

Comparison of Effects of Muscular Contraction.—J. E. Stuart, D. O., has made an apt comparison between the pull of the muscles of the back on the individual vertebrae and the well recognized insufficiencies of the ocular muscles. All physicians recognize the serious effects of long continued insufficiency of an ocular muscle, but few, indeed, have given any thought to the possibility of a similar condition affecting structures less moveable or less sensitive than the eye ball. The relation of a vertebra with its fellows is of great importance to the delicate nervous tissue which it surrounds. It is not necessary for a vertebra to press upon the spinal cord or nerve fibers coming from or going to it in order to produce irritation. There is a nerve strain in connection with these lesions which is not the result of direct pressure, but of

the efforts of the central nervous system to balance and coordinate the contraction of the muscles pulling on the vertebra. It is not necessary for divergent or convergent squint to be so marked that the expression of the eyes is instantly noted by all observers before any symptoms of eye strain are felt by the patient. Neither is it necessary for a vertebra to be dislocated in order to create a disturbance. It is conceivable that a completely dislocated vertebra might, after a time, cause as little irritation as an eyeball which is so divergent that no effort is made to use binocular vision. The body becomes accommodated to the change.

Fig. 43.—Flexion in the dorsal region showing spinous processes separated and superior articular processes partially uncovered.

Fig. 44.—Lateral view of same condition as *Fig.* 43.

Separation of Spinous Processes.—Figs. 43 and 44 give two views of the fifth, sixth and seventh vertebrae, illustrating the separation of the spines as in extreme flexion. Note that the superior articular facets are uncovered by the movement. The vertebrae assume this position in kyphosis. We frequently find that there is a gap between two spines while the spacing above and below is quite even. Either the space *directly* above or that below this gap is lessened. Fig. 45 shows the spines of the fifth, sixth and seventh dorsal vertebrae in the position of extreme extension. The spines crowd hard upon each other. These illustrations all show normal

positions, but they are the ones which our fingers discover as lesions of the vertebrae.

Approximation of Spinous Processes.—When two spines are closely approximated, as in Fig. 45, there is necessarily a widening of the next space above or below, depending upon which vertebra is affected. The contracted space will usually be sensitive to digital pressure. There is a contractured condition of the muscles causing this extreme movement of extension. This contracture disturbs the rhythm of nerve impulses from that section of the spinal cord in closest relation with the disturbed vertebra. There is a lack of co-ordination of movement in the affected joints.

Fig. 45.—Extension in the dorsal region showing approximation of the spinous processes.

When several vertebrae are tightly bound together, a straight, nonflexible spinal column is the result. The muscles are tightly contracted and more or less sensitive to digital pressure.

Subluxations—Primary.—These conditions as here illustrated are what osteopaths usually designate as spinal subluxations which are causative factors in disease. They are sources of irritation to the spinal nerves in direct central relation with them, and these nerves convey disturbed or arythmical impulses to the viscera and blood vessels, thus causing the various perversions of function which are recognized as symptoms of disease.

Subluxations—Secondary.—These lesions must also be recognized as structural changes resulting from excessive irritation to the peripheral end of sensory nerves, either those ending in skin and subject to the temperature changes, or those ending in the visceral mucosa and subject to irritation from the presence of food of an indigestible character, products of fermentation, etc. We must recognize the fact that sensory nerves are subject to excessive stimulation in cases of gluttony or masturbation. Both of these bad habits may result from the stimulation of a spinal lesion, but experience

Fig. 46.—Posterior view of five lower dorsal vertebrae, normal relations.

Fig. 47.—Side view of five lower dorsal vertebrae, normal relations.

with humanity teaches the physician that mankind in general delights in gratifying the senses. We do not wish to place spinal lesions at the bottom of man's moral weaknesses.

Limited Area for Lateral Subluxations.—Lateral subluxations may exist as low as the tenth dorsal spine. The articular processes of the eleventh and twelfth dorsal vertebrae take on the character of the lumbar, hence rotation is practically impossible. There is a digitation of the Rotatores Spinae between the eleventh and twelfth dorsal vertebrae.

Characteristics of the Eighth, Ninth, Tenth, Eleventh and Twelfth Dorsal Vertebrae.—Figs. 46 and 47 give a posterior and lateral view of the five lower dorsal vertebrae. The changing characteristics of the spinous processes of these vertebrae should be carefully noted, so that the student may not be misled as to the significance of that which his palpation may

Fig. 48.—Dorso-lumbar kyphosis. The patient is sitting as erect as possible.

discover. The eleventh dorsal spine takes a horizontal direction, and in some cases this makes either a very narrow space between it and the tenth or a very wide space between it and the twelfth.

Dorso-lumbar Articulation.—The junction of the dorsal and lumbar regions is very flexible. A large portion of flexion and extension of the spinal column is made in this articulation. The most common condition noticeable in the

lower dorsal region is increased prominence of the spines, and incipient kyphosis. This condition frequently affects the junction of the dorsal and lumbar regions, as in Fig 48.

Kyphosis—Lower Dorsal.—A slight kyphosis in the lower dorsal region is indicative of loss of tone in the extensor muscles governing the articular surfaces. The spines are separated farther than normal and the inferior articulating surfaces are partly uncovered by the superior ones. See Fig. 48.

Fig. 49.—Lumbar region. Side view—normal.

Fig. 50.—Lumbar region. Rear view—normal.

This weakened condition of the back may be brought on by injury, or reflexes from the bowels or kidneys. Continual vibration of the spinal column, as in cases of street car men, weaken the back, and then functional disturbances of the kidneys are noted.

Lumbar Region.—Figs. 49 and 50 illustrate the lateral and posterior appearance of the normal lumbar vertebrae. The spinous processes are easily palpated in this region. Their development varies enormously in different individuals. The formation of the articular processes prevents any rotation,

hence we do not find any lateral subluxations in this region. The position of individual vertebrae is rarely affected. "Breaks," that is, separations of the spines, are sometimes noted, but not often. Violence is the chief cause of these separations. The muscles in this region are thick and powerful, hence their influence is not exerted so much on individual vertebrae as upon the whole series of vertebrae. Therefore we find curves instead of subluxations in this region. Exaggeration of the normal movements is responsible for kyphosis, lordosis or scoliosis. Extreme weariness as a result of maintaining a sitting or standing position leads the individual to shift the weight of the body so as to take some advantage of the ligaments which limit a movement.

The strength and flexibility of the lumbar region is frequently a very good criterion of the patient's bodily vigor. It is easier to affect this portion of the spinal column by leverage movements than any other region.

Examination of the Ribs.—The position of the ribs is always noted by the osteopathic physician. It is noted in medical text-books on diagnosis that the general conformation of the thorax is indicative, to a variable degree, of either the past medical history of the individual or is evidence of the present existence or predisposition to certain diseases. A full, round, nonflexible chest denotes asthma or emphysema; flat chest denotes tendency to tuberculosis, etc. These statements are generalizations based on long observation, and are usually very near the truth. The respiratory movements should be noted, whether full and free compared with the capacity of the thorax.

The osteopathic physician goes farther than these excellent generalizations in his diagnosis. The relation and position of each individual rib are extremely important. The condition of the whole thorax, and its contents, is dependent on the relations of the bones which form it. With this idea in mind, a careful examination of each rib is made.

The ribs are, normally, quite moveable. Their spinal articulations are so arranged that an easy rise and fall of the shaft of the rib is permitted. The rise and fall is the result

of rotation of the rib on an axis passing through the costo-central and costo-transverse articulations.

Costo-central Articulations.—The costo-central articulations of the first, tenth, eleventh and twelfth ribs have no interarticular ligament. The movement of the heads of these ribs is limited by the capsular ligament. The heads of all the other ribs are held in place by interarticular ligaments attached to ridges on the heads of the ribs and to the intervertebral disks.

Costo-transverse Articulations.—The tubercles of the ribs articulate with the transverse processes of the vertebrae

Fig. 51.—Normal relations of the fifth and sixth ribs.

forming arthrodial joints. The superior costo-transverse ligaments prevent the dropping down of the costo-transverse articulation. There is very limited gliding movement in this articulation. As before stated, the movement in the costo-central and costo-transverse articulations is rotation. The shaft of the rib lies obliquely downward, therefore the rotation of the rib during inspiration turns the anterior extremity upward and outward. The axis of the rotation through the costo-vertebral articulations is obliquely downward, therefore the lateral position of the shaft of the rib is elevated during inspiration and the lower border is turned outward.

Co-ordination.—Fig. 51 illustrates the normal obliquity of the fifth and sixth ribs. When the contraction of all the

muscles of respiration is properly co-ordinated, the intercostal spaces are all equal in width. The respiratory rhythm should be equal in all parts of the thorax.

When through some nervous reflex, inspiration is made difficult, the inspiratory muscles expand the thorax to its fullest extent and retain the expansion. Then the diameters of the thorax are increased. This position of extreme inspiration is typical of the asthmatic chest.

Inco-ordination.—There may be lack of co-ordination of the muscles in any intercostal space. This inco-ordination may be manifested by too much contraction or relaxation. The result is a change in the normal width of an intercostal space.

Nervous Control of Respiration.—Respiration is carried on by a complicated mechanism. Its chief center of normal control is in the medulla, but subsidiary centers in linear series exist in the spinal cord. Each spinal nerve which innervates intercostal muscles or other muscles of inspiration arises from a subsidiary respiratory center. One of these subsidiary centers may become too active or passive as a result of local irritation, due to circulatory changes. The muscles governed by this disturbed center will not act harmoniously, hence the rhythmical movement of all the ribs is interfered with.

We have noted that spinal muscles contract unevenly as a result of direct spinal injury, exposure of the skin over them to cold, or from visceral reflexes. The respiratory muscles are subjected to the same conditions. A lateral subluxation in the dorsal region carries its articulated rib with it. Palpation will discover their changed relations. A kyphosis in the dorsal region causes the ribs to rotate upwards, thus increasing the diameters of the thorax. Lordosis in this region has the opposite effect.

Costal Subluxations.—Figs. 52 and 53 illustrate the changes in spacing of the ribs due to inco-ordination of muscular contraction. These positions of the ribs are spoken of as costal subluxations. In Fig. 52 the upper rib is rotated downward as a result of a contraction of the intercostal muscles of the space below it or the relaxation of those above it. Palpation elicits sensitiveness at the lower border of this fifth rib.

The sensitiveness is usually found where there is compression due to the dropping of the rib and the contraction of the muscles. This rib might have become displaced as a result of violence, or the patient might have been exposed to cold air while sweaty, or some disease of another part of the body might have caused sufficient weakness to allow this rib to drop as a result of pressure occasioned by the position in bed or otherwise.

Whatever the cause of these subluxations, they certainly become sources of great irritation to the nervous system. Sometimes the body becomes accommodated to these subluxations,

Fig. 52.—Approximation of the fifth and sixth ribs.

but the fact that cases of asthma have been cured, after years of suffering, by reducing these malpositions is prima facie evidence that accommodation is something that can not always be depended on.

The heads of the second to ninth ribs cannot be dislocated without rupture of the interarticular ligaments. Considerable change in the position of the shaft of the rib occasions very little change in the position of the head of the rib.

First Rib.—The first rib does not move in the same manner as those below. The attachment of the scalenus anticus keeps the shaft always raised. No matter how flat the remainder of the thorax may be, the first rib stands out promi-

nently. The chief change in its position is due to the contraction of the scalenus anticus, therefore it needs to be depressed rather than elevated.

Tenth Rib.—The head of the tenth rib is articulated with the body of the tenth vertebra, there is no interarticular ligament. This allows freer movement. Its anterior extremity is insecurely articulated to the cartilage of the ninth rib. This connection is frequently broken, thus making an added floating rib.

Eleventh and Twelfth Ribs.—The eleventh and twelfth ribs are very loosely articulated to the vertebrae. They

Fig. 53.—Separation of the fifth and sixth ribs.

have no costo-transverse ligaments, hence depend on the action of muscles to hold them in place. They are frequently found rotated upward or downward.

We have endeavored to show that the normal movements of the ribs as a whole may become very abnormal when made individually or out of rhythm with each other. The depressions or elevations of individual ribs have not dislocated their articulations; they have merely carried and retained them in positions out of harmony with the remainder of the ribs. They have become discordant members of a harmonious body, and unless made to co-operate for the general welfare, they will rapidly make other members inharmonious.

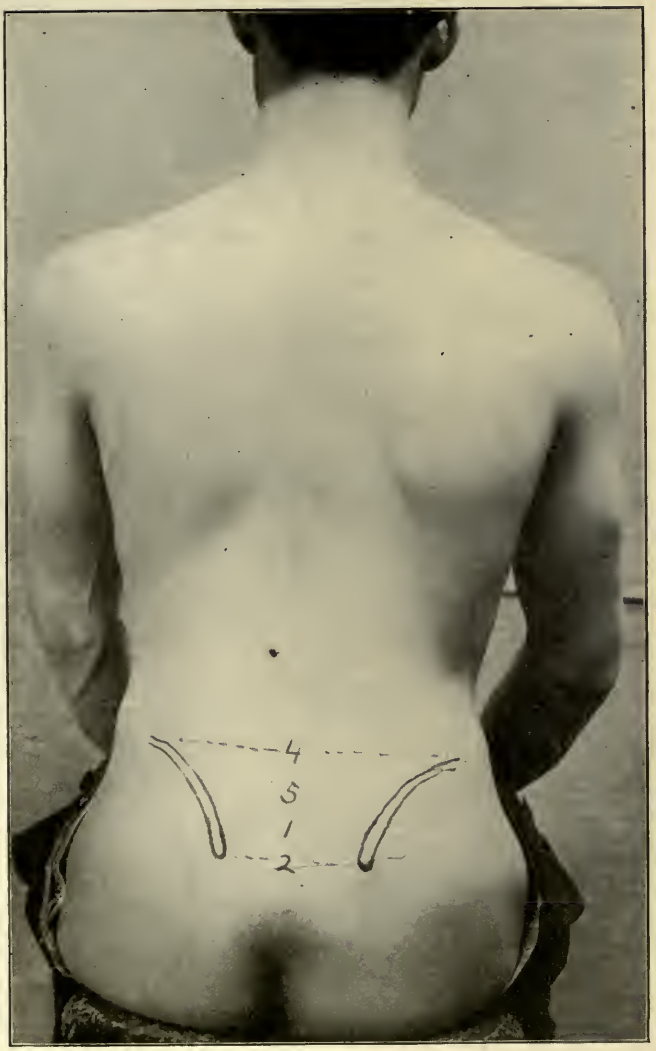


Fig. 54.—Normal surface markings of the relations of the sacrum and ilia.

Effect of Position of Vertebrae on Position of Ribs.—Lack of symmetry in the dorsal vertebrae causes a change in the position of the ribs. Both conditions can be corrected by reduction of the vertebral subluxations.

Clavicles.—The clavicles may be elevated or depressed by muscular contraction. Their depression affects the vessels crossing the first rib to and from the upper extremity. The subclavius muscle is responsible for depression of the clavicle.

Fig. 55.—Normal relations of sacrum and ilium.

Sacro-iliac Articulation.—The articulation between the sacrum and the ilium is variously described. Some claim it has a synovial membrane; others deny it. It may be that age and sex have much to do with this question. Ordinarily there is no movement in this articulation. It serves the same purpose for the pelvis as the cranial sutures do for the head, that is, to minimize shocks. The articular surfaces of the sacrum and ilium are covered with cartilage, the ligaments are strong, muscular contraction has no effect on their relative positions, nothing but a very severe shock could displace them.

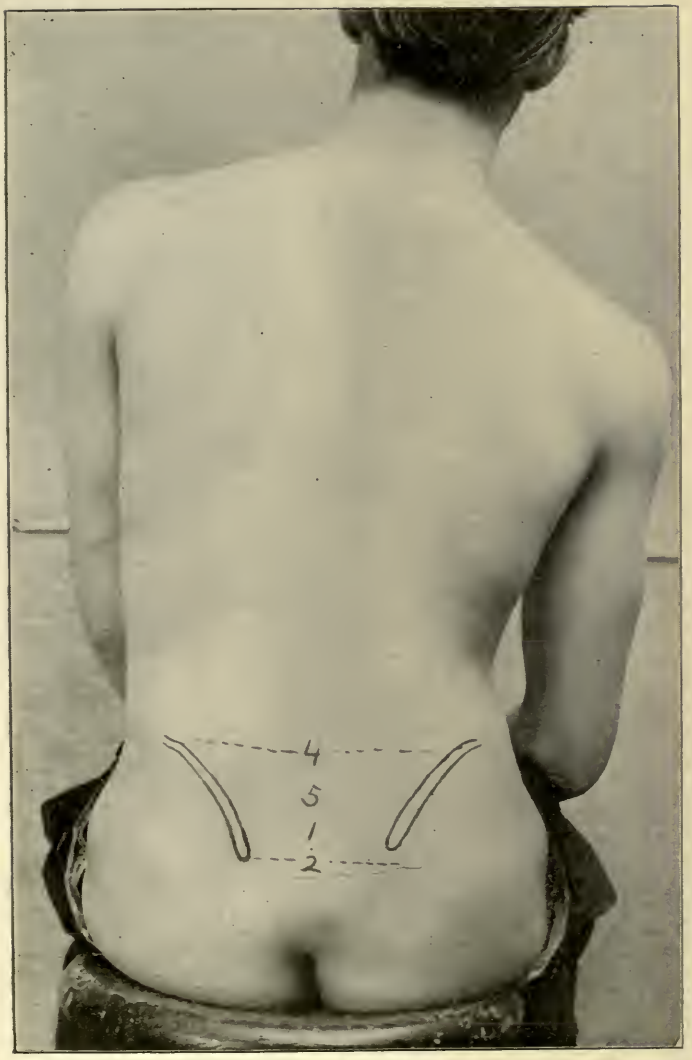


Fig. 56.—Upward and forward dislocation of the right ilium.

According to the above facts and our definition of the term subluxation, nothing but a dislocation can take place in this joint. There is no normal movement, hence any change in the relation of surfaces is a dislocation. Whenever the ilium is found raised above its normal relations with the sacrum, the patient will give a history of accident.

Fig. 54 illustrates the osseous relations on the posterior surface of this articulation. Normally the posterior superior spines of the ilia are on a horizontal line running through the

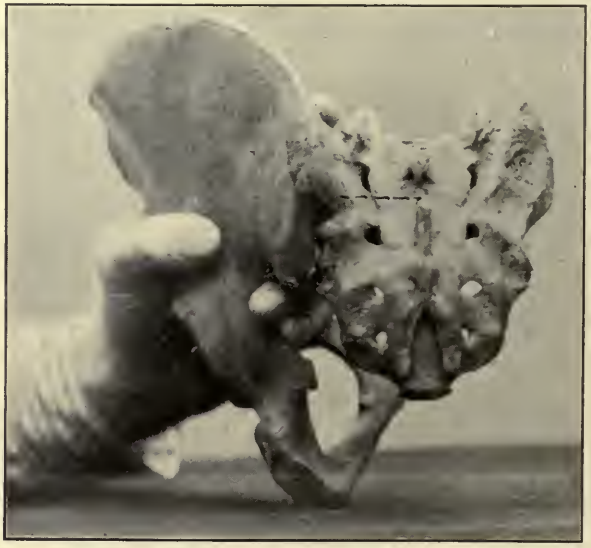


Fig. 57.—Ilium forced upward and forward.

second sacral spine. The crests of the ilia are on a level with the fourth lumbar spine. Fig 55 shows these bones in their normal relations.

The Nerves Affected.—The structures which are quite liable to irritation by dislocation of the ilium, are the nerves passing out and in through the great and lesser sacro-sciatic foramena; also the lumbar nerves in relation with the psoas magnus muscle.

Symptoms.—From the symptoms complained of in

five cases observed by the author, we note the following: first, a soreness on the bruised part, which soon ceases to attract attention, then pains in the extremity resembling rheumatism; about this time the patient seeks relief, is treated by the ordinary drug methods with no success. During these months of drug treatment the hip rotators begin to contract and stiffen the joint. Within eighteen months after the accident the hip

Fig. 58.—Ilium forced upward and backward.

joint has lost its function. It always becomes fixed in the extended position. Pain is practically constant.

Physical examination showed the relations pictured in Fig. 56. The crest and superior posterior spine of the ilium were above their normal relations. The leg on the injured side was shortened. These five cases presented almost exactly the same symptoms. The upward and backward position of the ilium is illustrated in Figs. 58 and 59.

The shape of the great sacro- sciatic foramen is changed.

Fig. 57 illustrates an upward and forward position of the ilium. The obliquity of the pelvis at the time of the accident has much to do with the direction in which the luxation

takes place. When the luxation is caused by a severe shock on the posterior surface of the tuber ischii, the ilium is twisted and the superior posterior spine is very prominent, but below the level of the second sacral spine. In one case examined the patient was jolted out of a spring seat and struck on the tire of the wagon wheel. The above described position of the ilium resulted. Fig. 60 gives the surface indications.

Fig. 59.—Posterior superior spine of the ilium is too prominent.

Hypersensitiveness will be found internal to the posterior superior spine of the ilium, center of the crest of the ilium and over the crest of the pubes.

Fig. 61 is a drawing from an X-ray photograph of a luxated left ilium. Quite a number of cases of luxated ilia have been reported in osteopathic literature. The reports are favorable. We are compelled to report unfavorably on all cases we have seen. This is a serious luxation, and one not easily reduced. None of my cases were examined osteopathically until after a lapse of two years. During these two years movement in the hip was lost and the ilia became absolutely fixed.

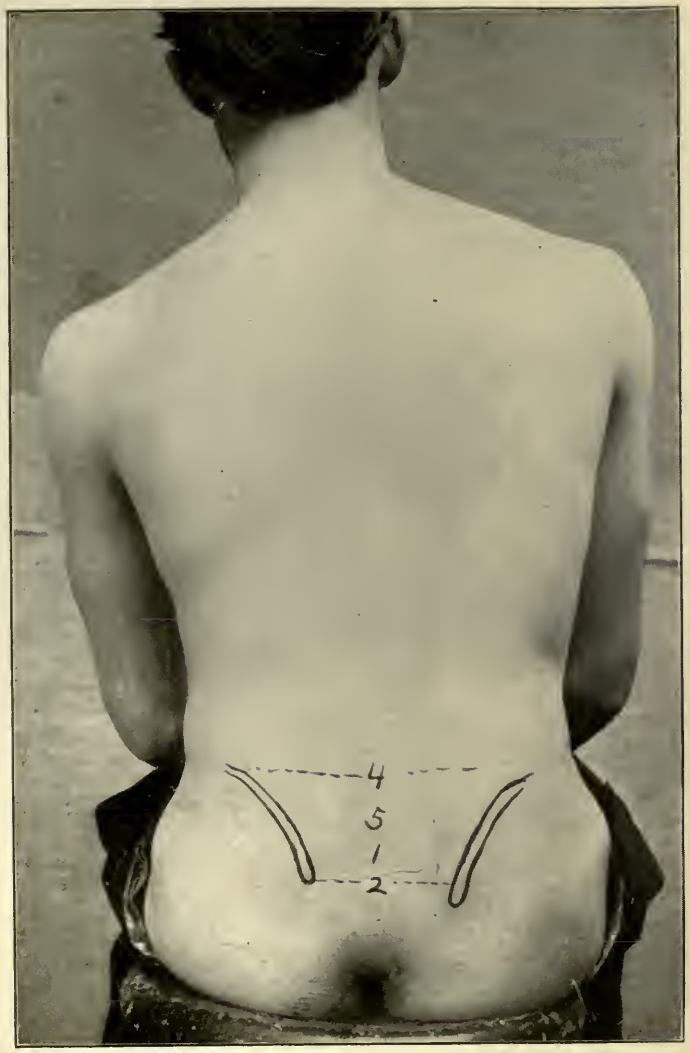


Fig. 60.—Posterior superior spine of the ilium is prominent and slightly below the second sacral spine.

In one case sufficient force was used to move the ilium, but it could not be forced into its normal position. Pain was greatly relieved in all cases.

Sacro-vertebral Articulation.—The articulation between the sacrum and fifth lumbar is one which is subject to

Fig. 61.—Dislocation of left ilium upward and backward. 1, Sacrum; 2, 5th Lumbar Vertebra; 3, 4th Lumbar Vertebra; 4, 4, Illiac Fossae; 5, 5, Head of Femur; 6, 6, Lesser Trochanter of Femur; 7, 7, Pubes; 8, 8, Obturator Foramen; 9, 9, Tuberosity of Ischium; 10, 10, Greater Sacro-sciatic Foramen; 11, Spine of Ischium.

great strain. The thick cartilage between the bodies of these bones allows considerable compression and thereby preserves the articulation from harm. It is not uncommon to find the fifth lumbar forced too far anterior by the obliquity of the sacrum. This articulation seems to be the one principally concerned in lordosis of the lumbar region. In connection with this malposition we find pelvic disorders resulting from irri-

tation of the hypogastric plexus situated on the anterior surface of this vertebra.

Every individual has his or her particular development. When examining patients this must be taken into consideration. All subluxations must be judged according to the condition of the reflexes along the nerve tracts which they might influence.

Summary.—A subluxation is evidence of unequal activity of opposing muscles, caused by twist, strain, fall, thermal change or reflex irritation from viscera. It is an evidence of vital activity unevenly manifested. The mechanical condition which we call a lesion may be only evidence of a lesion which lies in the excessively active muscle or at some other point in close nervous connection.

A subluxation may be called a primary lesion when it results from accident. It is secondary when due to reflex action. It is not always possible to determine whether a lesion is primary or secondary, but in general it is best to reduce them wherever found if any disturbance can be traced to them.

In rare instances one treatment has been found sufficient to reduce a subluxation. The fact that the majority of cases must be treated two or three months proves that they are not easily kept reduced.

CHAPTER X.

SOUNDS PRODUCED IN JOINTS BY MANIPULATION.

Normal Sounds.—It is not uncommon to hear peculiar sounds accompanying the normal movement of joints. These sounds are indicated by popular terms, such as "cracking," "snapping," and "popping." They are so common that every one has heard them, either in their own bodies or those of friends. Pulling the fingers is the best known method. It is commonly supposed that such a

method, if persisted in, will enlarge the joints. I doubt whether there is any proof of this. Doubtless the fear of it originated as an effort to frighten some one in whom the phenomenon was easily produced. Loose jointed people are able to produce sounds in many joints by carrying normal movements to the limit. Scarcely any moveable joint, in which the ligaments and muscles are normally relaxed is free from the possibility of producing sound when the opposing muscles are contracted unevenly; i. e., either the flexors or extensors predominating. The joint surfaces will slip upon each other suddenly, thus producing the sound. After it has been once made, it is rarely repeated without there has been an interval of rest during which the muscles change their tension. The cracking in the tempero-maxillary articulation can be repeated until the structures ache because it is occasioned by the sliding of the interarticular cartilage onto the eminentia articularis. The wrist and shoulder are capable of producing frequent sounds on account of their free movement and the many directions in which the force is applied.

Abnormal Sounds.—A large number of sounds which originate in joints are abnormal; i. e., the joints are not normal or else these particular sounds would not be produced. Some of these sounds are familiar to all physicians. They result from forced motion, actively or passively made, in a joint having limited movement as a result of injury; or intracapsular deposits due to disease. Another class of sounds are produced by forced movement, passive, in joints having lost some of the normal relations of their surfaces.

Pathology of Joints Producing Abnormal Sounds.—It may be well to recount systematically the conditions in which passive movement of joints produces sounds. In this way we can note the difference between the characters of sounds usually recognized by physicians, and those especially peculiar to manipulative treatment of subluxations.

The breaking of adhesions between articular surfaces produces a sound comparable to that occasioned by the

breaking of a green stick in which the fibres break individually as the force becomes greater and greater.

Synovial adhesions are due to many causes, the simplest of which are slight injury and non-use of a joint. An injury sufficient to cause slight efforts at repair, when accompanied by rest, will result in a few adhesions. Voluntary movement of the joint is arrested by these adhesions. Such conditions frequently follow a sprain or the splinting of a joint, just above or below a fracture. The joint may be quite well, but by keeping it perfectly fixed during the repair of the fracture, the periarticular structures loose their elasticity and a few adhesions may form within.

Sometimes a timid person may be so fearful of moving a slightly sprained joint that adhesions form and control of the joint is lost. I was recently called to examine a foot which was very painful and useless. Seven months previously the ankle was sprained. The foot had not been used since that injury. Found the foot stiff, cold and resting on a pillow. Examination revealed slight motion which seemed to be limited by elastic bands. There was no inflammation of the foot. Sudden force applied first in direction of flexion then extension, caused a series of cracking sounds which indicated the rupturing of adhesions. The range of motion instantly increased. If these adhesions had been broken six months before, much of the muscular atrophy of the leg and thigh would have been avoided.

A patient with broken femur, having been kept in bed twelve weeks was unable to move the knee on account of adhesions formed during period of non-action due to splinting. Forcible flexion of the knee a little each day gradually broke the adhesions until movement was nearly normal.

These are the cases with which all physicians are familiar. The sounds produced are not repeated at any time following the first forcible movements. Such adhesions as these are due to rest, not without some slight injury. I do not believe that non-use alone is capable of causing adhesions.

Rheumatic joints sometimes manifest conditions similar to sprains. Adhesions form during the period of inflammation and persist after its subsidence. Rupturing these by sudden force frequently restores normal movement.

All the foregoing conditions are the result of some degree of inflammation. Forced movement breaks the adhesion, which makes a sound as it breaks. There is no repetition of the sound in succeeding movements.

The semilunar cartilages of the knee joint may become displaced and cause great pain, with loss of motion. A case recently under treatment gave history of frequent accident of this kind while riding a bicycle. When extending the leg to push the peddle down, the force was exerted with the knee somewhat everted. Excruciating pain came on suddenly and the leg could not be extended. Examination revealed a very sensitive spot at the outer and anterior surface of the joint. The semilunar cartilage slipped forward and blocked the extension of the joint. By taking the leg between my knees and making thumb pressure on the painful prominent spot, then gently flexing and slightly rotating the tibia on the condyles of the femur, followed by quick extension, a distinct sound was elicited and the action of the joint was restored. The sound indicated replacement of the cartilage.

It has been supposed that much of the work of osteopaths consisted in breaking adhesions which were simple enough, but happened not to have been strictly attended to by the surgeons. There is much chance to misinterpret the work of the osteopaths in reducing subluxations. Medical men of established schools of medicine have failed to closely analyze the structural condition of joints before and after manipulation, hence they have jumped to the conclusion that all of our work was of that kind, called "bone setting," for want of a better descriptive term. This appelation, "bone setting," is a popular one, first used in England to describe the work of individuals, usually uneducated, who treated patients by manipulation of joints

which they said were "out." Quick forceful movements in the directions of normal joint actions usually resulted in a "popping" sound. When this occurred, the "bone setter" considered his work accomplished.

Aside from adhesion the conditions which we find limiting the movements of joints are subluxations. Wharton P. Hood, M. D., M. R. C. S., furnished the Lancet a description of what was commonly called "bone setting." His articles were published in that journal, March and April, 1871. The articles were published in book form, the same year entitled, "On Bone Setting (so called) and Its Relation to the Treatment of Joints Crippled by Injury, Rheumatism, Inflammation, etc." Dr. Hood made close observations of the work of a "bone setter,"—Mr. Hutton. This gentleman sought to teach Dr. Hood his art as a matter of gratitude for professional attention given him by Dr. Peter Hood. In the pages of this book I find a clear, concise exposition of the bone-setter's art, together with a record of the observations of the author, who had the advantage of excellent training in the medical arts. There is no doubt in my mind as to the similarity existing between the conditions which were recognized by so-called "bone setters" and those which have formed the basis for the successful advancement of Osteopathy. The difference lies principally in the educational qualifications. Dr. Hood notes that the manipulations were made without any knowledge of anatomy and physiology, but were nevertheless astonishingly successful, and he calls attention to the fact that much greater success with less probability of injury ought to result from these manipulations when the true pathology of the joint is understood; i. e., when the operator is in fact a trained surgeon thoroughly versed in the details of anatomy. Dr. Hood evidently did not understand the conditions which we recognize as subluxations of the ribs and vertebrae, although he came very near to it, as you will observe hereafter. His attention was principally fixed on the conditions following greater or lesser degrees of joint inflammation resulting in intra-articular

adhesions or extra-articular contractions. In the case of adhesions, breaking them causes a sound which can not be repeated, but subluxations may occur repeatedly in the same joint, each reduction causing a sound.

In Dr. Hood's chapter on Pathology, I find the following: "Subluxations of tarsal and carpal bones must occur, I think, in a considerable number of instances. I mean by subluxations, some disturbance of the proper relations of a bone, without absolute displacement; and I believe that such disturbance may be produced either by the traction of a band of adhesion about the joints, or by a twist or other direct violence."

Grant the possibility of subluxation in the arthrodial joints of the carpus and tarsus, it is not improbable to conceive of them in any other joint. As a pure example of "bone setting," one of my recent cases is apropos. A lady stepped on some small hard object, the point of contact being just under the instep. Sharp pain, localized on top of the instep, began at once and was not relieved by heat or other antiphlogistic measures. Forty-eight hours after the onset of pain I was called to examine the foot. Found some swelling over the instep, but palpation localized the pain in the articulation between the scaphoid and internal cuneiform. Any attempt at local movement of this joint caused sharp pain. The patient could not stand on the foot on account of the pain, which was increased thereby. Extention of the foot with firm pressure on the upper side of the articulation caused a very loud sound, the prominence of the scaphoid was not so apparent, and the patient could put her weight on the foot immediately. This was a case of tarsal subluxation. If the same degree of displacement had existed in a vertebral articulation, the effect on circulation in the nerve centers of the cord might have caused very wide spread symptoms.

The subluxations treated by "bone setters" have usually been those which occasioned pain in the joint. The osteopath does not depend upon conscious pain as a symptom of subluxation, but makes palpation the true guide.

When the head of the femur is forced out of the acetabulum, there is more or less tearing of ligaments, with consequent inflammation. Replacement of the head is not accomplished without a distinct sound. The sound is considered as audible evidence of successful operation. The same is true of the shoulder joint. The great range of movement in these joints necessarily requires lax ligaments, therefore great separation of the joint surfaces is possible. The arthrodial joints in all parts of the body are constructed on a different principle. The range of movement is not great in them, and their ligaments are comparatively short. The form of the bony surfaces of the arthrodial joints does not limit motion as is the case in enarthrodial joints.

Replacement of the head of the femur, or humerus requires it to move over a ridge of bone or cartilage, and when it sinks suddenly into its proper pace a sound is heard. Probably the sound which accompanies the reduction of a subluxated arthrodial joint can be explained by the sudden readjustment of joint surfaces, even though there is no ridge of bone or cartilage to glide over. It is hardly probable that a subluxated joint has its surfaces smoothly, though in a limited area, opposed to each other. Forcing a greater area of contact, corrects the unevenly opposed surfaces.

A subluxation may be reduced slowly, and in such an instance no sound is heard. Quick, sharp force is required to overcome the periarticular tension which will result in sudden replacement with sound.

The use of the statement by some osteopaths that a "joint is out" or a "bone is out" is merely the direct appropriation of the "bone setter's" pet phrase. The use of the phrase "there, it's in," or some similar one when the sound of the reduction is heard, is also an appropriation from the same source. These phrases are unscientific, and should not be used by any one who pretends to understand the true pathology of the condition he is treating. In the case

of sound due to the breaking of adhesions, we could not truly say a "bone is out," nor in the case of subluxation is it right to describe it thus. If it is adhesion, call it so; and if a subluxation, describe it carefully. In this way definite knowledge of joint conditions will be gathered.

There is some difference of opinion between osteopaths as to whether a subluxation must give forth a sound when properly reduced. Discussions of the subject thus far have not settled it. It seems that the statement made previously in this chapter that slow reduction of a subluxation by relaxing movements will not cause a sound, but forceful and sudden relaxation will do so, about covers the facts. We know that subluxations are reduced by both methods with satisfactory results.

Elsewhere I have called attention to the treatment of subluxations. (Chapters XVIII and XIX). For comparative purposes, and that the student may know what was understood concerning the manipulative treatment of the spinal column, previous to the advent of osteopathy, I quote a portion of Dr. Hood's chapter on "Affections of the Spine."

"I fear it must be admitted that the great importance of the spinal cord, and the gravity of its diseases, have rather tended to make professional men overlook the osseous and ligamentous case by which it is enclosed, and which is liable to all the maladies that befall bones and ligaments elsewhere. The quack on the other hand, who probably never heard of the spinal cord, recognizes the presence of structures with which he is familiar, and deals with them as he does in other situations. The result is much the same as in the hip joint. The quack every now and then cures conditions which the authorized practitioner had regarded with a sort of reverence because they were "spinal;" and he every now and then kills a patient because this reverence did not exist for his protection. If the profession generally would so study the diseases of the spinal cord as to rescue them from specialists, the first step would

be taken towards rescuing the diseases of the vertebral column from quacks.

"However, the matter may be explained, it is quite certain that many people now resort to bone setters, complaining of a "crick," or pain or weakness in the back, usually consequent upon some injury or undue exertion, and that these applicants are cured by movements of flexion and extension, coupled with pressure upon any painful spot.

"In a few cases, Mr. Hutton was consulted on account of stiffness about the neck or cervical vertebrae; and he then was accustomed to straighten them. * * * His left forearm would be placed under the lowered chin of the patient, with the hand coming round to the base of the occipital bone. The right thumb would then be placed on any painful spot on the cervical spine, and the chin suddenly elevated as much as seemed to be required. As far as my observation extends the instances of this kind were not bonafide examples of adhesions, but generally such as might be attributed to slight muscular rigidity, or even to some form of imaginary malady. The benefit gained was probably rather due to the pain of the operation and the effect produced by it upon the mind of the patient than to any actual change in the physical condition concerned.

"For the lower regions of the spine he had two methods of treatment differing in detail, but not in principle. In the first, when the painful spot was found the patient was made to get out of bed and to stand facing its side, with the front of the legs or perhaps the knees—according to the height of the patient and of the bedstead—pressed against it. She was then told to bend forward until the bed was touched by the elbows. His left arm was then placed across the chest, and the thumb of the right hand upon the painful spot. Firm pressure was then made with the thumb, and as soon as he felt that he had settled himself into such a position that he could obtain the full power of the left arm, the patient was told to assume the erect posture with as much rapidity and vigor as she could com-

mand. This movement was facilitated and expedited by the throwing up of his left arm and the opposing force of the right thumb. As a rule there seemed to be two painful spots, answering to the upper and lower border of the affected vertebrae, so that the manoeuvre would require to be repeated.

"In the second method the patient was seated in a chair placed a short distance from the wall, so that the feet could be firmly pressed against it. She was told to bend forward and place her arms between her legs, with the elbows resting against the inner side of the knees: to sit firmly on the chair, and at a given signal to throw herself upright. The operator passed his left arm under the chest, placed his right thumb on the painful spot, and, in order to obtain firm and resisting pressure, rested his elbow against the back of the chair. The signal being given, the operator, keeping the fist clenched, so as to support his thumb, and the elbow being held firm in its position, when the patient throws herself upright, resists the approach of her back to the chair, and bends her head and shoulders as far backwards as possible, the position of the feet preventing any forward movement.

"These two methods are used for cases in which pain is present in the dorsal vertebrae below the eighth, or in any of the lumbar. The treatment used for the upper dorsal and lower cervical vertebrae was to place the operator's knee against the painful spot, and, with the hands placed upon the shoulders to draw the upper part of the body as far back as possible.

"In cases where pain was complained of, in the dorsal and lumbar region, and the backward movements did not afford the required relief, the patient was made to bend sideways, and a similar process was gone through as in the other manipulations.

"As a commentary on all this, there is manifestly little to say, except that the size of the vertebral column is such as to admit of considerable diminution without injury to the cord, and that the bones and ligaments of the column

as already observed are liable to the same results of injury, and to the same diseases, that befall bones and ligaments elsewhere.

"The surgeon who is consulted about a case of spinal malady should first of all make sure that he is not frightened by a bug bear, and should then proceed to determine by scientific methods of examination whether or not he is in the presence of disease of the nervous centres, or of caries, abscess or other destructive change in the vertebral column. On such points as these, no man who possesses a thermometer, a microscope and a test tube has any excuse for remaining long in doubt; and if he is able to exclude the possibility of such conditions, he may then regard the spine simply as a portion of the skeleton, and may deal with it accordingly. Here, as elsewhere, injury and rest, or rest and counter irritation, may produce adhesions that painfully limit movement and that may at once be broken by resolute flexion and extension. Here, as elsewhere, partial displacement may occur and may be rectified by pressure and motion. In the lower cervical the dorsal and lumbar portions of the spine, the change of position of any single vertebrae can only be slight—enough to produce pain and stiffness, but not enough to produce visible deformity. In the highest region, however, partial dislocations are sometimes more manifest. The following case is quoted from the hospital report of the Medical Times and Gazette of August 5th, 1865; 'John S....., aged 21, laborer, of St. Mary's Cray, was admitted on May 26th, 1865, under Mr. Hilton. States that he has been ailing for the last three months; loss of appetite and general debility; has, however, followed employment. On Sunday, May 14, he was stooping down to black his boots as they were on his feet, when suddenly he "felt a snap" in the upper and back part of his neck; he felt as if someone had struck him there. About a quarter of an hour after he became insensible and continued so about half an hour; then he felt a stiffness
8 and numbness at the sides and back of his head and the back of his neck, with a fullness in the throat and difficulty

of swallowing. At first he had no loss of power over his limbs, only slight pain down his right arm; some days after admission, however, he had partial loss of power in the right arm, which shortly recovered itself. On admission he carries his head fixed, and has pain on slightest attempt to rotate, flex, or extend the head; his jaw is partially fixed, and he can not open his mouth wide enough to admit of a finger being passed to the back of the pharynx; his voice is thick and guttural; deglutition not attended by any great uneasiness. Complains of all symptoms before enumerated. Externally, over the spine of the second cervical vertebrae, there is a tumor hard and resisting, but tender on pressure; this is evidently formed by the undue prominence of the spine of the axis itself; the tenderness is not general, but circumscribed; the parts all around are numb. He was put on his back on a hard bed, his head was slightly elevated and a small sand bag was placed beneath the projecting spine; and the whole head maintained in a fixed position by larger sand bags. He was ordered pulv. Dov. gr. V; hydr. c. creta; gr. iij., bis die. This was continued for about ten days, when his gums became affected slightly, and it was then omitted. Marked improvement has taken place in his general appearance and more particularly in his special symptoms. He continued thus till July 3, gradually and steadily improving. He then had acute rheumatic inflammation of the right knee and elbow joint, followed in a day or two by a similar state in the left knee joint. There was no evidence of a pyaemic state. The joints were blistered, he has been treated with pot. nitr. and lemon juice and is now fast recovering. The tenderness and all the symptoms have disappeared, the projection still remaining, and he expresses himself much relieved by the continued rest in bed."

"Mr. Hilton, in remarking on this case, observed that it had been demonstrated that the area of the vertebral canal might be diminished by one-third, provided that the diminution was slowly effected, without giving rise to any

alarming, or indeed marked symptoms of compression of the cord.

"Now, there can be no doubt that most surgeons would agree that Mr. Hilton exercised a sound discretion in simply placing this man in conditions favorable to recovery, or in keeping him at rest until the axis was fixed in its new position, and the spinal cord accustomed to the change in its relations. There can be as little doubt that Mr. Hutton would have made thumb pressure on the prominent spine while he sharply raised the head. The probability is, that he would by this manoeuvre have cured his patient; the possibility is that he might have killed him. This sort of "make a spoon or spoil a horn" practice we may contentedly leave to quacks; and without risking reputation in doubtful cases. I think we may find a considerable number which are not doubtful, in which skilled observation may exclude all elements of danger, and in which the rectification of displacement, or the rupture of adhesions, will be certainly followed by the most favorable results. For the discovery of these cases no settled rules can be laid down, since they can only be known by negations—by the absence of the symptoms that would give warning of danger. The diagnosis must be made in each instance for itself, and in each must depend upon the sagacity and skill of the practitioner."

CHAPTER XI.

OSTEOPATHIC CENTERS.

Certain points on the surface of the body are spoken of as *"Centers."* This word has become a part of the osteopath's technical vocabulary. It does not convey to the mind of the osteopath the same meaning which attaches to it when used in physiological text-books.

A physiological functional center in the central nervous system is that point where the action of a certain viscus or other structure is governed.

An osteopathic center is that point on the surface of the

body which has been demonstrated to be in closest central connection with a physiological center, or over the course of a governing nerve bundle.

In Chapter III, under the sub-heading *Segmentation,* reference is made to the division of the central nervous system into sections which may, to a moderate degree, functionate independently. No portion of the nervous system ever functionates absolutely independently. The action of every portion affects all other portions, but certain areas in the brain and spinal cord seem to be somewhat set apart to govern or coordinate the physiological activity of certain organs. Physiology has demonstrated a large number of these centers.

"Physiology shows how not only the individual ganglia which lie in the intestines function with relative independence, but how even structures like the spinal ganglia frequently reckoned in with the central system still enjoy relative independence from it functionally."

"What we know of the anatomical structure and of the functions of the central nervous system of vertebrates forces us more and more to the conclusions (1) *that even individual parts of the central system are themselves in a position to function to a certain extent independantly, and* (2) *that even the brain and spinal cord of vertebrates are composed of a series of centers.* Whether the one or the other of these is more highly developed, whether they are in connection with deeper centers, whether they have connections among themselves and with higher centers, determine the measure of the higher or lower development of the central system. We will find later that, in the course of the development of a class, individual centers connected with the central nervous system have reached a high development, while others have arrived at a certain stage (or reached a certain type) where they remain stationary, and throughout all subsequent posterity remain everywhere alike.

"One can conceive that in its essentials every nervous system is composed of afferent tracts and efferent tracts, and of tracts which form the connection of the elements among themselves." (Anatomy of the Central Nervous System of Man and of Vertebrates in General. Edinger, page 26.)

Anatomy and Physiology demonstrate that from a certain segment of the spinal cord nerve fibres are distributed to skin, skeletal muscles, involuntary muscles and mucous membrane of viscera, and to the muscular coats of the arteries supplying all these structures.

Physiology and Pathology demonstrate that impressions made upon sensory elements in skin, mucous membrane, muscle, or other structures, are carried to a center in the central nervous system. These impressions are co-ordinated in this center, and affect the physiological action of all structures innervated from the same center. When we speak of two or more structures being in close central connection, we mean that they are innervated from the same segment of the central nervous system.

Diagnosis.—In diagnosis these segments serve the purpose of calling the osteopath's attention to the condition of several correlated structures. For example: A hyperaesthesia at any point along the spinal column fixes the attention of the osteopath upon all the structures of the body which are innervated from the segment of the central nervous system which furnishes nerves for this over-sensitive area. Examination of all the structures thus supplied will probably discover the point chiefly affected.

In order to give the student a clear insight into the principles underlying osteopathic diagnosis, we will examine the osteopathic centers serially, commencing at the atlas.

First Four Cervical Nerves.—We will first divide the spinal column into sections according to the location of certain groups of nerves. Remember that these divisions are made with reference to the points of exit of the spinal nerves from the spinal column.

The first section contains the first four cervical nerves. The first cervical nerve leaves the spinal canal between the occipital bone and the atlas. A study of its distribution will inform us what structures are governed by it. Its anterior division forms a part of the cervical plexus. This division communicates with the sympathetic nerves on the vertebral artery, the pneumogastric, the hypoglossal, and superior cervical sym-

pathetic ganglion. It innervates the Rectus Lateralis and Anterior Recti.

The posterior division of the first cervical nerve is called the suboccipital. It supplies motor fibres to the posterior Recti muscles of the head, the Superior and Inferior Oblique, and the Complexus. Sensory fibres from the scalp form part of this nerve.

Example of Hilton's Law.—With this outline of distribution before us, we can note some of the results of stimulation of this nerve. Since the anterior division supplies a few fibres to the occipito-atlantal articulation, we have an example of Hilton's law of distribution of a nerve trunk. The synovial membrane of the occipito-atlantal articulation, the muscles which govern movements of the joint, and the skin over the joint are all innervated by this first cervical nerve.

The muscles moving the occipito-atlantal articulation act according to impulses reaching the point of origin of the first cervical nerve over sensory fibres ending in the skin covering the back of the head and this articulation, also from those ending in the synovial membrane of the joint. These impulses are co-ordinated in higher centers of the brain which govern equilibration. The muscles of this joint act also according to our will.

The Pneumogastric Nerve.—Furthermore, the anterior division of this nerve communicates with the pneumogastric, hypoglossal, and the superior sympathetic ganglion. The pneumogastric has such a wide distribution that we cannot afford to follow all of its paths of influence at this time. The student is referred to any extended work on anatomy for the details. The muscles and mucous membranes of the larynx are innervated by the pneumogastric, hence any irritation of the larynx may reflex impulses to the center of origin of the first cervical nerve and cause undue contraction of the muscles innervated by it. This muscular contraction can result in changing the relation of the bones forming the occipito-atlantal articulation until a condition exists which we call a subluxation of the atlas. Having followed the impulses from the larynx to the center of co-ordination and out again to the mus-

cles of the occipito-atlantal articulation with consequent subluxation, we may profitably note the fact that sudden temperature changes may affect the skin over these muscles, arousing impulses which are carried to the center of co-ordination, thence to the muscles, causing them to contract with resulting subluxation. Some of the reflex impulses may find their way to the larynx and cause congestion of its mucosa. The atlas may be subluxated by violence, then the sensory impulses originate in the synovial membrane of the joint and in the muscles moving the joint. These impulses may be reflected in such manner as to affect the larynx, pharynx and other structures innervated by the pneumogastric. The reflex influences existing between the first cervical nerves and the pneumogastric are chiefly confined to the larynx and pharynx, because spinal nerves usually receive sympathetic reflexes from the segment of the body which they cover. If we should follow all of the divisions of the pneumogastrics, we would find a wonderful diversity of distribution. We do not expect that reflexes from the heart, lungs, stomach, etc., are going to be subject to co-ordination in the area of origin of the first cervical nerve, just because there is communication between the pneumogastric and this nerve. The pharynx and larynx are, in part, structures governed involuntarily, and hence they are in large part removed from the influence of nerves carrying voluntary impulses, i. e., spinal nerves. The pneumogastric is essentially sympathetic in character. The tissues of the larynx and pharynx are practically under the influence of the first cervical nerve. Your attention is called to Hilton's law as he has stated it in relation to mucous and serous surfaces. "This same principle of arrangement, anatomically, physiologically and pathologically considered, is to be observed, with an equal degree of accuracy in the serous and the mucous membranes. Thus considered, it presents a principle which, if it has any application in practice, must be one certainly of large extent."

Since the spinal accessory forms part of the pneumogastric above the point of communication between that nerve and the first cervical, we can perceive the reason for the great

influence which temperature changes, affecting the skin over the sterno-cleido-mastoid and trapezius muscles, have on the action of the muscles forming the suboccipital triangles. The spinal accessory innervates the sterno-cleido-mastoid and trapezius. These muscles will contract reflexly when the sensory nerves in the skin over them are affected by temperature changes. The action of these muscles affects the position of the head chiefly by causing movement in the occipito-atlantal articulation whose accurate adjustment depends on the muscles innervated by the first cervical nerves.

The point of origin of the first two cervical nerves is probably a bilateral center. In order to secure co-ordinated movements, both sides of this bilateral center must act reciprocally, but if the impulses coming into the center from one side are much greater in number and intensity than those entering on the opposite side, this reciprocity of action may be interfered with and subluxation result.

The Hypoglossal Nerve.—The Hypoglossal nerve is the motor nerve to the muscles of the tongue, and to the muscles moving the larynx and hyoid bone. It communicates with the first cervical nerve. Movement in the occipito-atlantal articulation affects the relations of the points of origin and insertion of the muscles innervated by the hypoglossal; therefore, impulses passing over both nerves are co-ordinated at about the same area.

Superior Cervical Ganglion.—Probably the greatest cause for disturbance along the course of the first cervical nerve is the communication with the superior cervical ganglion and the sympathetic plexus on the vertebral artery. This communication subjects all the structures innervated by the first cervical to reflexes initiated in various areas of the head, neck and brain.

The superior cervical sympathetic ganglion has a vaso-constrictor influence over the blood vessels of the head, neck and brain. It is a well known clinical fact that ice applied to the surface of the neck over the occipito-atlantal articulation will cause constriction of the blood vessels of the brain. This constriction is a reflex effect due to the communication of the

first cervical nerve with the superior cervical sympathetic ganglion.

Suboccipital Triangles.—When the first cervical nerve is sensitive to moderate pressure over the suboccipital triangles, we may be sure that it is evidence of disturbance of circulation in some part of the head, neck or face. We look for this disturbance in the structures which are subjected to the greatest amount of work, i. e., the eye, pharynx or larynx. The brain, last, because it is not easily fatigued. Sensitiveness is nearly always associated with a subluxated atlas, i. e., one is indicative of the other.

Whether the subluxation is primary or secondary, it is a source of irritation and must be reduced; therefore, in practice our treatment is applied primarily to this changed structure. The results of practice prove this to be the best method.

Patients rarely complain of sharp neuralgic pain in the area of the suboccipital triangles. A dull ache or tension is the usual subjective symptom.

We have described the characteristics of this center with considerable detail in order that the student may understand how thoroughly an accurate knowledge of anatomy and physiology enters into the work of the osteopath. Every center must be understood in this same manner. We do not deem it necessary to go into such detail in describing all of the remaining centers in order that the student can understand their significance.

In order to make the characteristics of the first cervical nerve stand out prominently, we have described it as though it were individual in its action and reaction. This is not strictly true. Analysis compels us to note ill-defined separations in the nervous system. In order to get a right conception, we must view the first cervical nerve as only one of a group of four cervical nerves which act in harmony.

Cervical Plexus.—The first four cervical nerves are interwoven to form a plexus. Each distributive branch from this plexus probably contains some communicating fibres from the four primary nerve trunks. Viewing the plexus as a whole, we find that its branches are distributed according to

Hilton's law. They innervate the skin of the neck as low as the fifth cervical spine posteriorly, then obliquely forward as low as the sterno-clavicular articulation anteriorly, and the acromio-clavicular articulation laterally. The skin of the posterior surface of the cranium and the ear receives sensory fibres from this plexus. These are the gross points to be remembered concerning cutaneous sensory distribution from this plexus. The muscles under this cutaneous area all receive motor fibres from the first four cervical nerves.

Anatomists divide the cervical nerves into anterior and posterior divisions, then describe these separately. This is an artificial division which does not serve any useful purpose for us. It multiplies detail without giving an adequate conception of the real character of the whole nerve. When you study the ultimate distribution of the anterior division of a nerve forming the cervical plexus, do not fail to remember that the ultimate distribution of the posterior division is a part of the same nerve. If the anterior division communicates with a sympathetic ganglion, the posterior division receives impulses from and sends impulses to this ganglion. If the anterior division communicates with the vagus and hypoglossal nerves, the posterior division is a party to this communication, and in all ways benefits or suffers by it according to the number and intensity of the stimuli applied at any point along the course of either nerve.

This upper portion of the neck is the most flexible part of the whole spinal column. It is subjected to more changes of temperature and more strains or twists than other portions of the spine. The constant effort to save the head from injury puts a severe tax upon the activity of the muscles moving this portion of the spinal column. Subluxations of the atlas and third cervical are quite frequent. Muscular lesions, contractions, are found here in connection with functional disorders of many kinds located in the brain, eyes, ears, nose, mouth or throat. Almost invariably a relaxation of these contractions will be a necessary step in relieving disorders in the areas named.

Intensity of Reflexes.—Individuals differ greatly in

the intensity of their reflexes. Anatomatically considered, the connections between the sympathetic and cerebro-spinal systems are alike in all individuals, but physiologically considered, there is a vast difference in the degree of independent functioning of these systems. Patients will be found whose symptoms and lesions do not show any marked tendency toward reflexing impulses from one system to the other. The sympathetic nerve cells may be so vigorous that severe lesions affecting cerebro-spinal nerves do not in the least disturb the rhythm of the sympathetic system. Likewise severe functional disturbances may exist in the area of the sympathetic control without causing very definite conscious sensations.

The Spinal Accessory.—The sterno-cleido-mastoid and trapezius muscles are innervated by the spinal accessory. This nerve arises from the spinal cord as low as the sixth cervical, therefore, its impulses are co-ordinated with the cervical plexus in the area of its normal control.

The Phrenic Nerve—Hiccough.—The phrenic nerve is the motor nerve from the cervical plexus. It innervates the diaphragm. It is formed by branches of the third, fourth and fifth cervical nerves. The position of this nerve in its course along the anterior surface of the scalenus anticus, makes it convenient to apply direct inhibitory pressure over the nerve trunk. This pressure has a restraining influence over the impulses traveling to the diaphragm; therefore, we inhibit to stop hiccough. We have treated cases in which inhibition was of no avail. In such cases a strong movement of the head and first three cervical vertebrae, as a solid lever, to secure rotation and relaxation between the third and fourth cervical vertebrae may give good results. Since hiccough is a reflex due to stimulation of sensory nerves, especially the pneumogastric, it should not be expected that inhibition of the motor nerve, phrenic, would entirely stop hiccoughs while the sensory stimulation is continued. Clinically, we find that inhibition of the phrenic nerve is sufficient to stop the ordinary case of hiccoughs. Therefore, we call the area over the course of the phrenic nerve, as it crosses the scalenus anticus muscle

opposite the fifth cervical transverse process, the "center for hiccoughs." See Fig 165.

The Tapezius and Splenius Capitis et Colli Muscles.—The cervical plexus communicates with the brachial plexus; therefore we expect that those large muscles, such as the trapezius and splenius, which are innervated by nerves from segments of the spinal cord, at various levels, will transmit by their action the influence reflexed to them at any point of their serial innervation. The spinal accessory innervates a large part of the cervical fibres of the trapezius. The third and fourth cervical nerves send branches to this muscle. Therefore any distrubance along the course of these nerves, or along the course of other nerves in close central connection with them which may cause abnormal contraction of the trapezius, will influence, more or less, all the points of attachment of that muscle. The trapezius is seldom abnormally contracted. Any lessening in the normal range of its action is quickly noted by the patient. The contractured condition is easily removed by a willed action. We use the trapezius muscle as a means of transmitting power to various portions of the spinal column, i. e., in our efforts to move one or more vertebrae.

Vaso-motion, Head, Face and Neck.—The superior cervical ganglion communicates with the first four cervical nerves, therefore the area over the spines of the first four cervical vertebrae is called a vaso-motor center for the head, face and neck.

Affections of the Cervical Nerves.—These upper cervical nerves are seldom paralyzed. Paralysis in this region would stop the action of the diaphragm. Neuralgia may affect the nerves of this group. Spasmodic contraction of the muscles innervated from this area is not uncommon.

Brachial Plexus.—The four lower cervical nerves arise from the cervical enlargement of the cord and form the brachial plexus with their anterior divisions, while their posterior divisions supply motor fibres to muscles on the sides and back of the neck, and sensory fibres to the skin over these muscles. The anterior division of the first dorsal nerve forms a part of the brachial plexus.

Fig. 62.—Surface marking of the brachial plexus.

Figure 62 illustrates the superficial area in which the reflexes from the skin and muscles of the arm are manifested. Subluxations, or muscular contractions, in this area may affect one or more branches of this plexus.

Affections of the Brachial Nerves.—Neuralgia, paralysis or spasm may affect the area innervated by this group. Cervico-brachial neuralgia is quite common. A lesion will usually be found affecting the painful nerve at its point of exit from the spinal column. Paralysis rarely affects this plexus independently of the nerves leaving the cord at a lower level. Spasm is represented by such a condition as writer's cramp.

Lesions causing cramp or neuralgia may be located at the point of exit of the nerve from the spinal column, but the clot or other pressure causing paralysis is usually located in the brain. Paralysis of the brachial plexus is a part of a hemiplegia; it does not occur independently of the more general condition. Paralysis of certain groups of muscles of the arm, forearm or hand can usually be traced to the direct injury of individual nerve trunks in the arm.

Hemiparesis Below Fifth Cervical Vertebra.—Figures 63, 64 and 65 illustrate the results of pressure upon the spinal cord at a point between the fourth and fifth cervical vertebrae. The child was not very strong at the time of the injury. A slight fall, while playing, subluxated the fifth cervical. No notice was taken of this slight fall. The next day, while bathing the child, the mother noted a peculiarity in the position of the shoulder. The arm could not be raised above the head. The author examined this case the day the mother discovered the change in the shoulder. At first glance from the side, it appeared to be a sub-spinous dislocation of the humerus, but palpation disproved this. Careful examination showed a hemiparesis of the whole left side below the fourth cervical nerve. None of the normal movements were lost, but it required the utmost effort of the patient to make them. Now and then the left toe would strike the floor too soon and slightly trip her. Palpation of the fifth cervical vertebra showed a lateral

subluxation. The slightest pressure at this point caused the patient to cry out with pain.

After our examination (these photographs were taken at that time) the child was taken to a surgeon, who prescribed a surgical operation to stitch the latissimus dorsi to its proper

Fig. 63.—Front view of case of unilateral paresis.

position on the lower angle of the scapula. He did not recognize the paretic condition of the whole left side. After a short time, the child was brought to us for treatment. Our sole effort was to reduce the subluxation of the fifth cervical vertebra. The tenderness was so great that this was manifestly out of the range of possibilities with a delicate child.

After two weeks of relaxing around this articulation a direct movement was made to reduce the subluxation. The alignment was perfected, but no immediate good results were noted. A continued increase in nerve power has gradually, in large measure, overcome the deformity.

Subluxation of the Scapula.—The deformity is the effect of uneven contraction of muscles. The latissimus dorsi,

Fig. 64.—Side view of case of unilateral paresis.

rhomboids and serratus magnus are weakened while the levator anguli scapuli and cervical fibres of the trapezius are contracting with their customary power. The muscles innervated by nerves from above the lesion are acting normally, but their action is not resisted. *This results in subluxation of the scapula.*

The Nerve of Wrisberg.—A division of the first dorsal nerve forms the first intercostal nerve. The inner and

back side of the arm receive cutaneous branches from the first dorsal nerve. There is communication between the cutaneous nerves to this area and the second intercostal nerve by means of the nerve of Wrisberg, hence pain is frequently felt along

Fig. 65.—Rear view of case of unilateral paresis.

the inner surface of the arm in cases of heart trouble, intercostal neuralgia in the second space, or pleurisy.

The Interscapular Region.—The division of the spinal column between the first and seventh dorsal vertebrae is commonly called the interscapular region. It is an exceedingly important one. It is sometimes called the pulmonary region, because it is the area from which the lungs derive many nerves. Sensory impulses from the lungs are co-ordinated in this area.

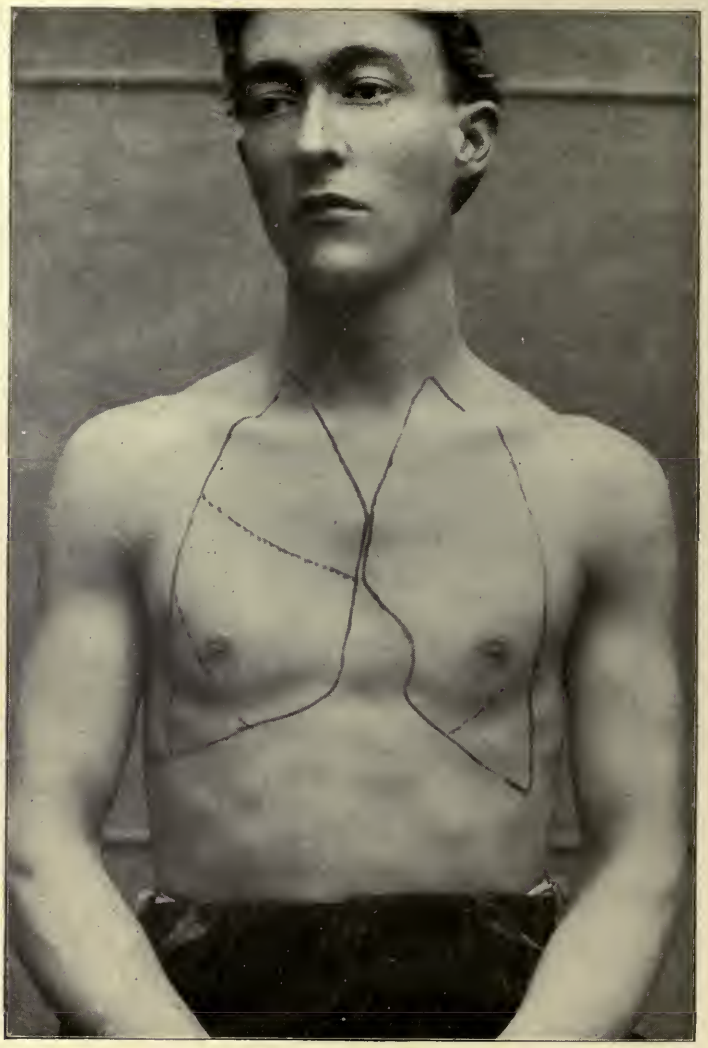


Fig. 66.—Anterior surface markings of the lungs.

Figure 66 illustrates the anterior surface outline of the lungs, while Fig. 67 shows the outline on the posterior surface of the thorax. These markings were made on the surface according to physical methods of diagnosis. They represent the average position of the lungs in a healthy man.

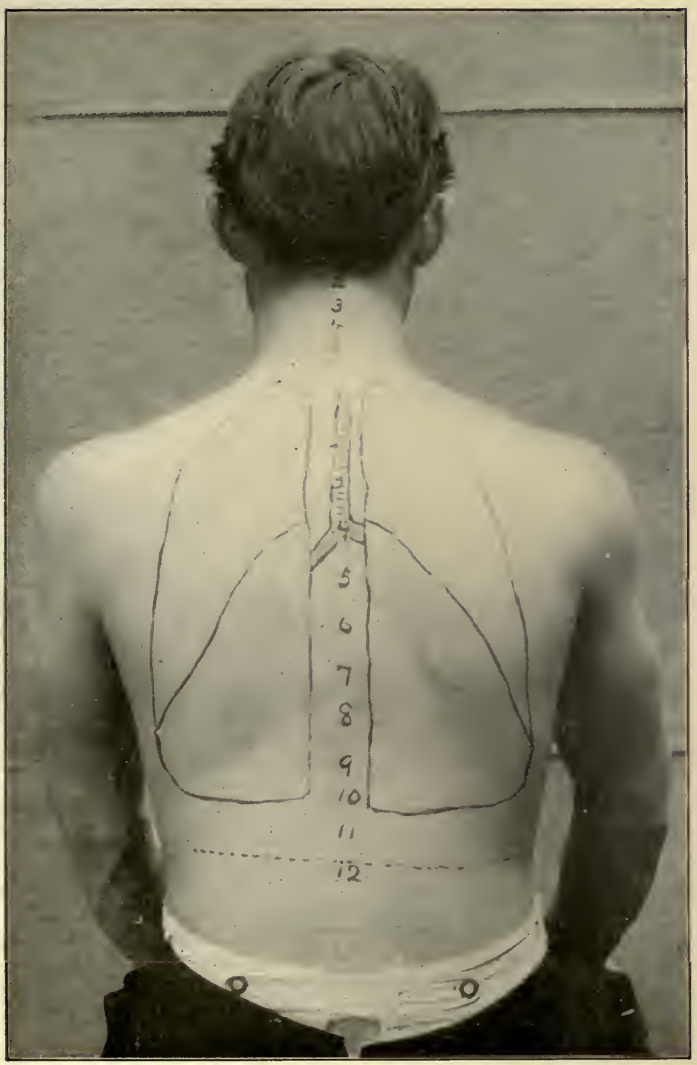


Fig. 67.—Posterior surface markings of the lungs.

Lung Center.—Figure 68 illustrates the lung center within which sensory impulses from the lungs are co-ordinated. A large proportion of cases of bronchitis, pulmonitis or pleuritis of either the simple or bacterial types, are accom-

panied by great sensitiveness in this area. This sensitiveness is in the contracted muscles or, when the shape of the thorax is greatly changed, at the angles of the ribs. Subluxations of ribs or vertebrae in this area are sometimes found in connection with the inflammations above named. Whether they are the cause or the effect of the inflammation can only be told by the history. Because the two conditions, that is, inflammation in the thoracic viscera and osseous subluxation, exist at the same time is no reason for saying that the subluxation is necessarily the cause of the inflammation. That is a mere dogmatic assertion which lacks scientific proof. The condition might be just the opposite. We do not desire to confuse our readers in the least, but it should be remembered that before making a dogmatic statement such as "disease is the result of anatomical abnormalities followed by physiological discord," we should be certain that our statement is not based on a series of selected coincidences. The old saw: "It's a poor rule that does not work both ways," is decidedly applicable to nerve reflexes.

Cilio-spinal Center.—Tenderness in this area is not necessarily indicative of physiological disturbance in any thoracic viscus. Fig. 69 indicates two centers. The one between the second and third dorsal is called the cilio-spinal center. Detail concerning this center will be found in the chapter on The Sympathetic Nervous System.

The fact that the vaso-constrictor fibres to the cervical sympathetic ganglia leave the spinal cord below the second dorsal vertebra show that some reflexes from the head, face and neck may be co-ordinated in the interscapular region.

Heart Center.—The point between the fourth and fifth dorsal spines is noted as a heart center. We have not found any text-book authority for this statement. Clinical experience leads the author to locate a heart center at this point. What the absolute influence of this center is we do not know. From observation of cases of angina pectoris it appears to be a sensory and vaso-motor center for the heart. Stimulation of this center by a quick percussion stroke of the fingers will bring on an immediate attack of pain in the heart, blueness

Fig. 68.—The lung center.

of lips and finger tips. Heavy digital pressure at this point relieves the pain. Steady extension of the whole spinal column does not stimulate such cases, but as the pull is reduced and the vertebrae are drawn closer together, this point is fre-

Fig. 69.—Cilio-spinal and heart centers.

quently stimulated. In order to avoid an attack after extension, it is necessary to lessen the force of the pull very gradually and evenly.

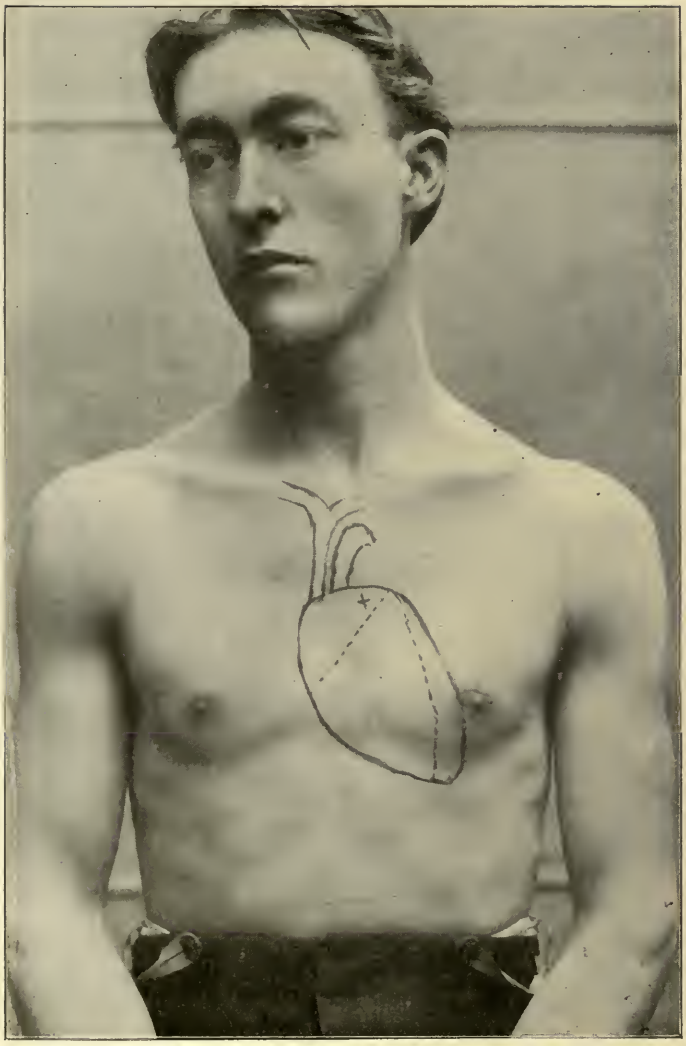


Fig. 70.—Surface outline of the heart.

Fig. 70 illustrates the surface markings of the heart. This organ has three centers. (1) The pneumogastric nerve exerts an inhibitory influence. This nerve can be stimulated in the neck. See Fig. 166. (2) The accelerator center in-

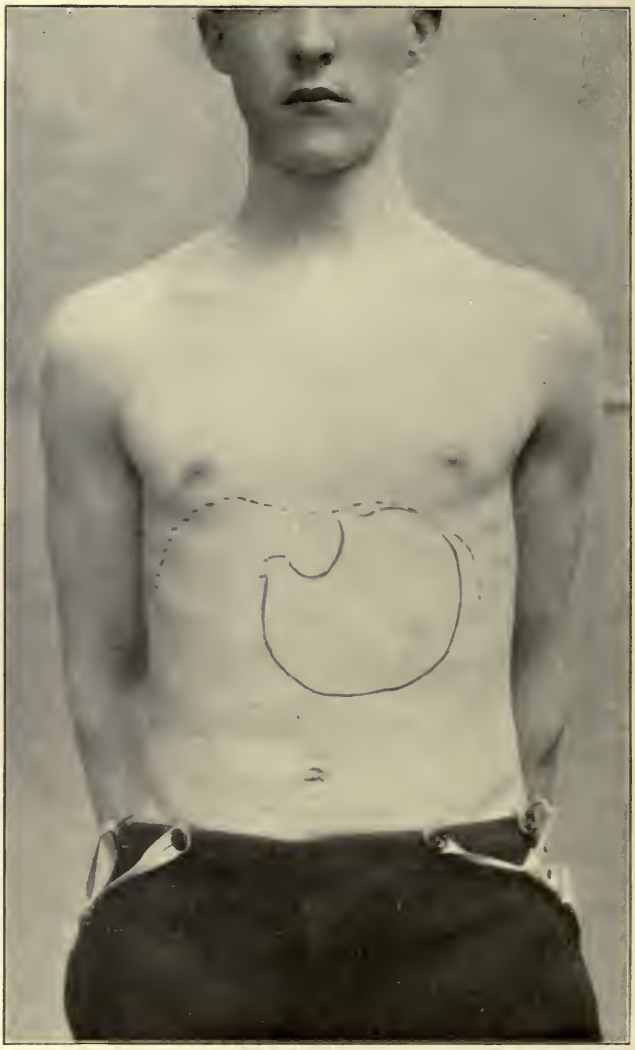


Fig. 71.—Surface outline of the stomach.

cludes second, third and fourth dorsal. See Chapter VI on the Sympathetic Nervous System. (3) Vaso-motor and sensory center is found between fourth and fifth dorsal.

Fig. 72.—The stomach center.

Stomach Center.—The surface outline of the stomach is given in Fig. 71 while its reflex surface center on the back is indicated in Fig. 72. This center lies wholly within the pulmonary area, therefore it will be readily noted that there

Fig. 73.—The splanchnic area.

is opportunity for much careful reasoning in order to determine whether a lesion between the first and seventh dorsal vertebrae is connected with disturbance of the lungs, pleura, heart, eyes or stomach. Clinically, we distinguish somewhat

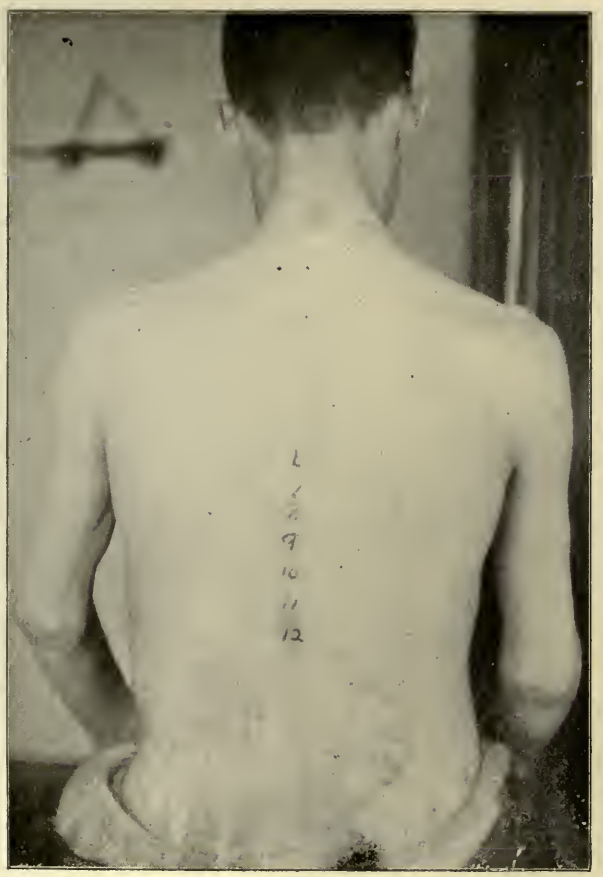


Fig. 74.—Posterior view of a case of leukemia.

as follows: A lesion covering a large part of this area is probably pulmonary. A lesion in the lower half and extending below the seventh spine is probably gastric in character. When the lesion is at the third or fourth and decidedly limited i. e., the tenderness is sharply circumscribed in this area, it is impossible to tell, except by further examination of the heart, bronchi and eyes, to which it belongs. The experienced diagnostician can frequently estimate the probable relation of a lesion by his power of reading the signs of disease as evidenced by expression, posture and general indications.

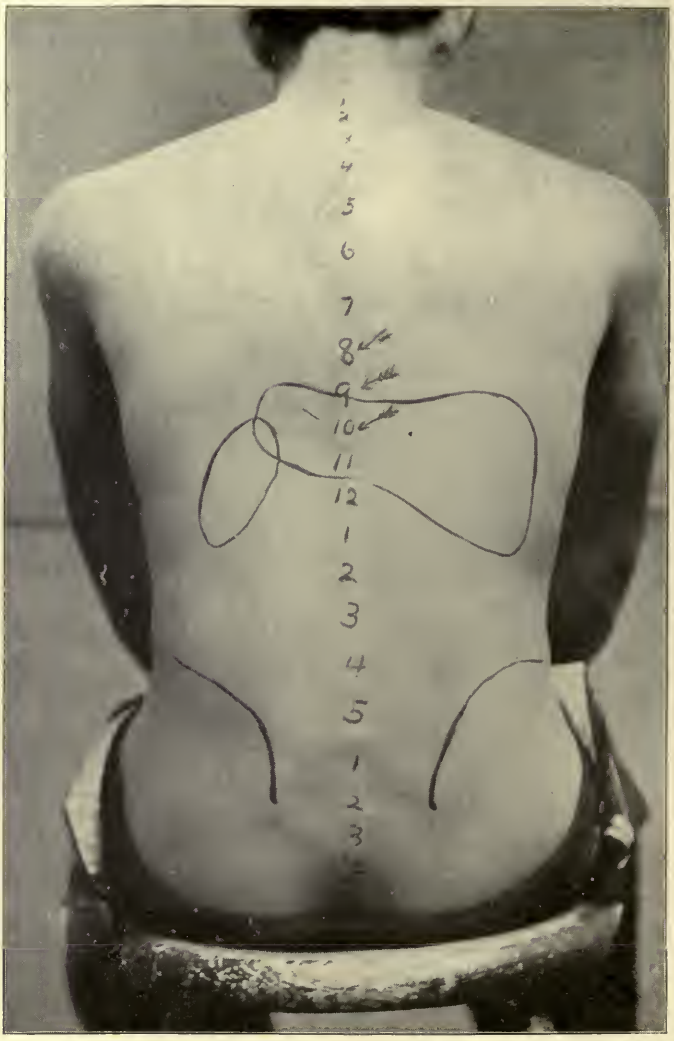


Fig. 75.—Posterior surface outline of the liver and spleen with their centers indicated.

The splanchnic area is a large and important one. It is indicated in Fig. 73. We have noted in this photograph the upper connections of the splanchnic nerves in the pulmonary area. This explains the high position occupied by some re-

Fig. 76.—Side view of case of leukemia.

flexes from the first part of the gastro-intestinal tract. Wonderful influences can be secured in this area, over circulation in the abdominal viscera. The physiological actions governed from this area are described on page 125. (See Great Splanchnics under the Sympathetic Nervous System, Chapter VI.)

Leukemia.—To illustrate the osteopathic view of the effect of osseous disorder on the functional activity of viscera, we present a series of three photographs, Figs. 74,

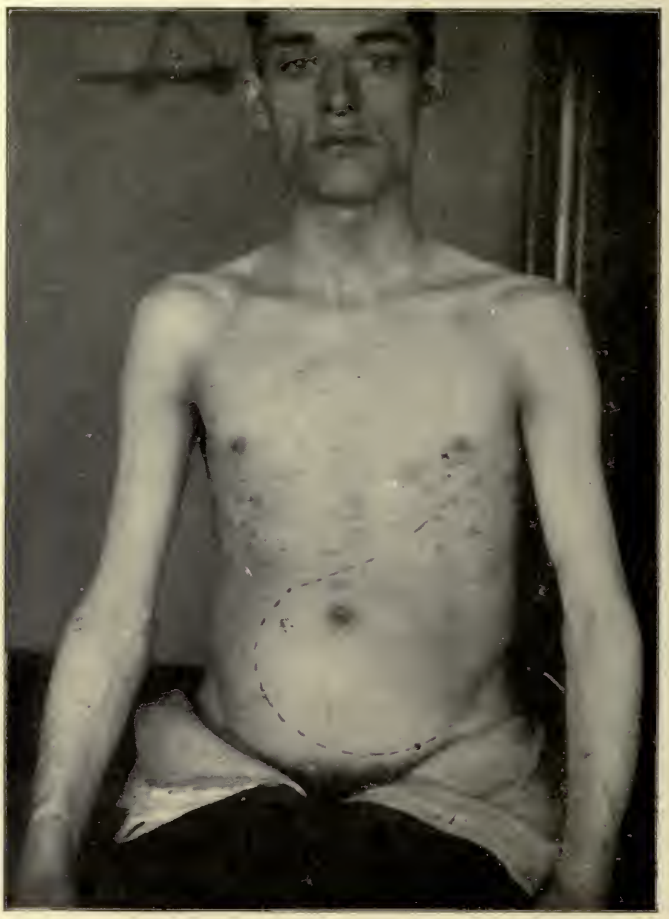


Fig. 77.—Anterior view of case of leukemia.

76 and 77, of a case of leukemia showing the condition of the spine in the splenic area. The marked limited kyphosis in connection with the enlargement of the spleen is a striking example of the relation existing between a viscus and its center. This case has been in our clinic only a short time, two weeks, therefore we cannot tell what the effect of the treatment will be. It is an extreme case. The blood examination shows thirty per cent of hemoglobin. The number of

Fig. 78.—Anterior surface outline of the liver and large intestines.

white blood corpuscles is 448,000 to the cubic centimeter, that is, about forty-four times the usual number.

The treatment is being limited to the spinal area involved. Thus far the patient notes cessation of all pain.

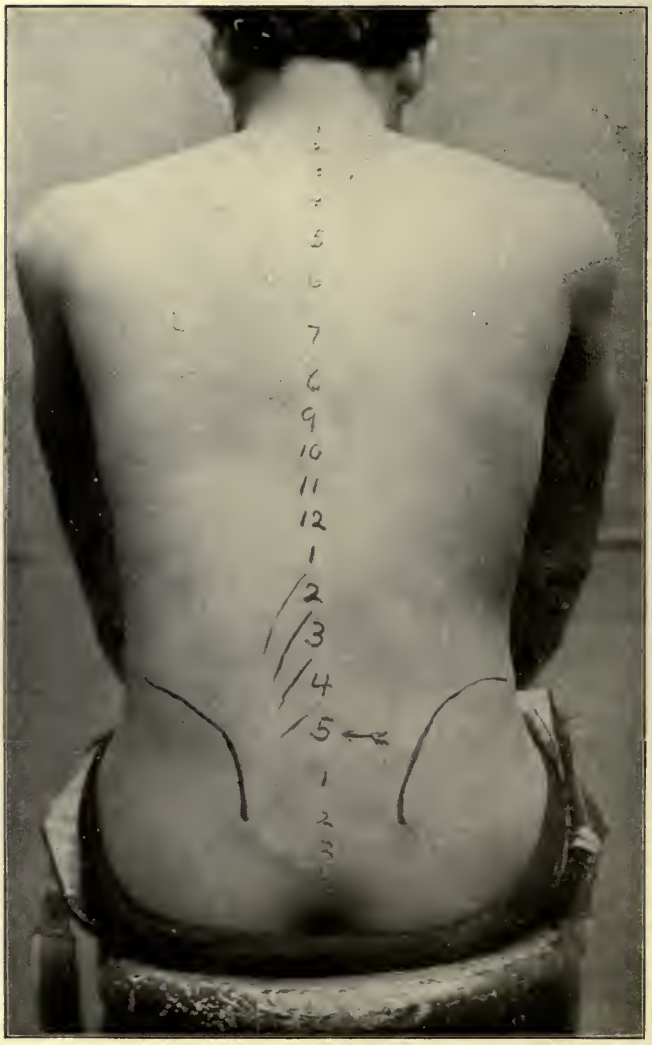


Fig. 79.—Center for large intestine. The arrow marks point of close connection of cerebro-spinal nerves with the hypogastric plexus.

Liver and Spleen Center.—The liver and spleen receive their sensory and vaso-motor innervation from the eighth, ninth and tenth dorsal nerves. The surface markings and

Fig. 80.—Center for chills.

center are indicated by Fig. 75. The liver frequently reflexes its disturbed sensory influences to the right shoulder. We have noted cases of gastric disorder or enlarged spleen which reflexed sensory impressions to the left shoulder.

Large Intestine.—Fig. 78 pictures the surface mark-
9 ings of the liver and large intestine. These average normal outlines should be thoroughly remembered and used when

Fig. 81.—Center for the gall bladder.

making a physical examination. The spinal center of the large intestine is indicated by Fig. 79.

Small Intestine.—The first portion of the small intestine, duodenum, is innervated from about the same area as

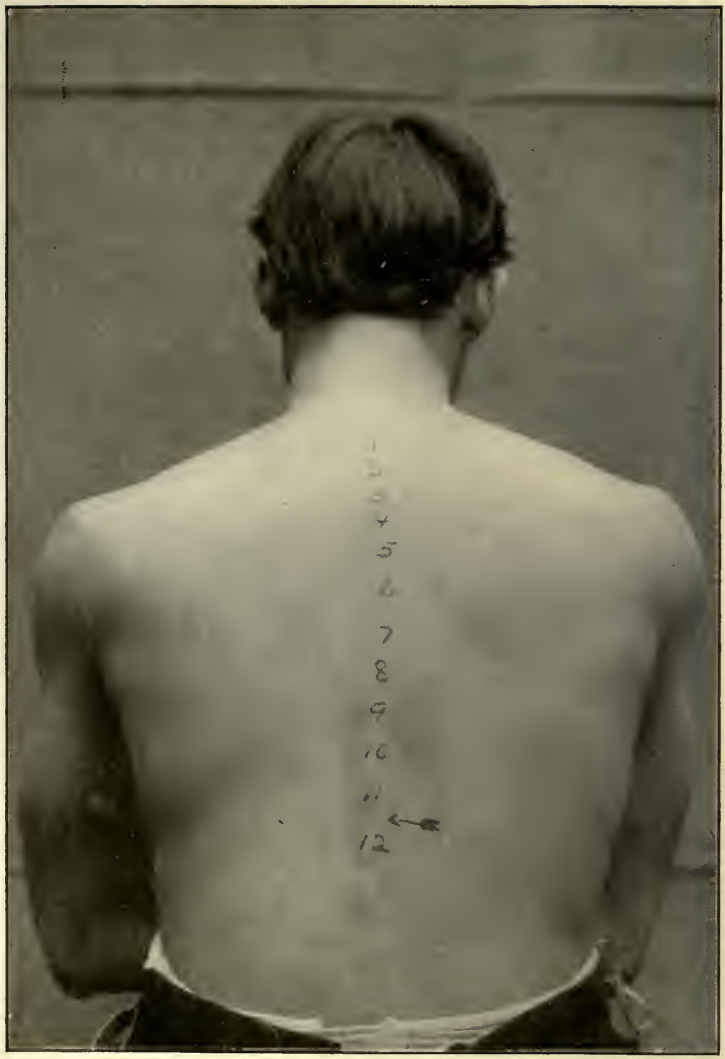


Fig. 82.—Center for the ovaries. Reflexes from the ovaries may follow the ovarian plexus to the aortic and reach the cerebro-spinal system at this point. This is true for the testes also.

the liver. Fig. 80. It must be borne in mind that the splanchnic area is a large one and comprehends these smaller centers. Many of these points indicated as centers are the

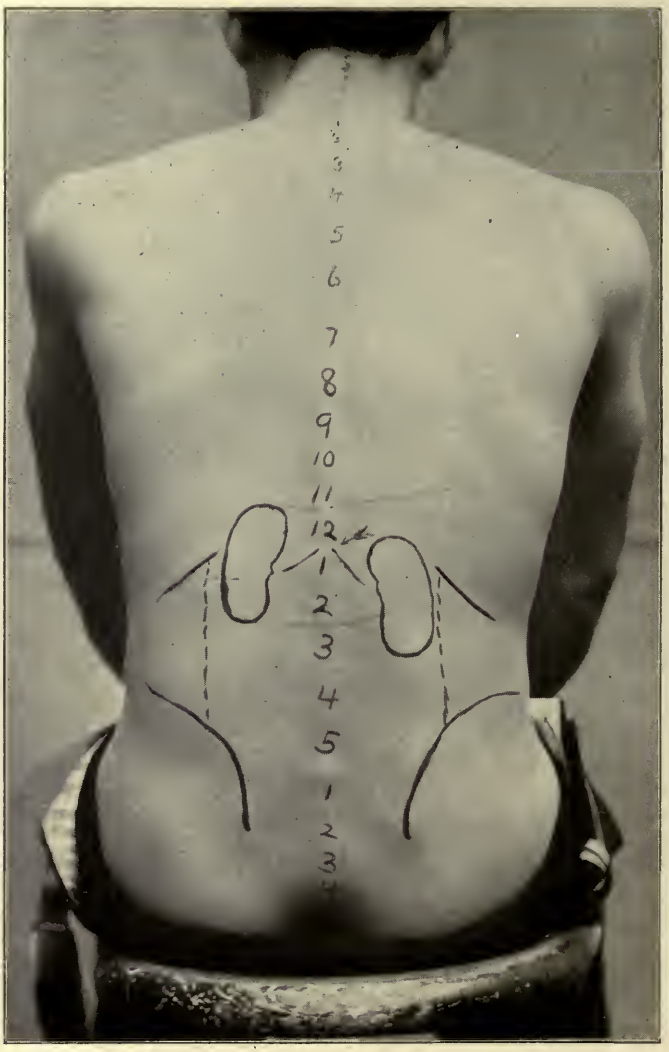


Fig. 83.—Posterior surface outline of the kidneys.

areas which clinical experience has noted in connection with visceral disturbance. The repeated experience of many cases gives them value for diagnostic and therapeutic purposes.

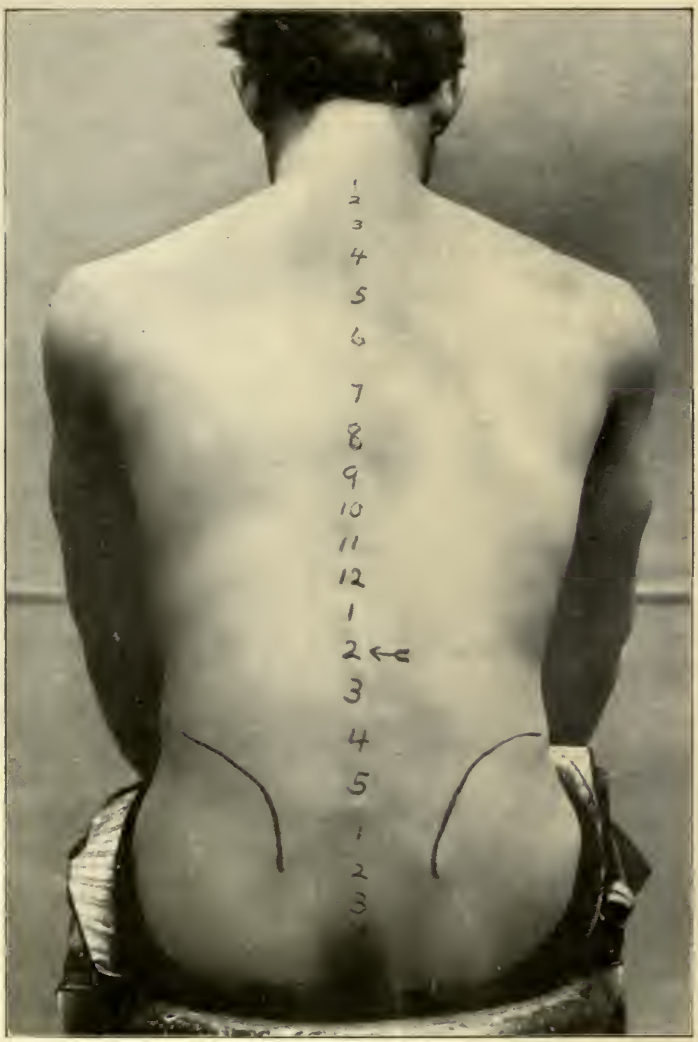


Fig. 84.—End of the spinal cord. Physiological center for parturition, defection and micturition.

Center for Chills.—Within the area indicated by Fig. 80, there is a center usually described as the eighth dorsal, which has received the name of "the center for chills." Our first observation of the action of this center was in connection

with a case of malarial fever. Heavy inhibition of this area lessened the severity of the chill. By following this method from day to day, at the time of the onset of the chill, this case was cured. Another case treated at the same time did not respond to this line of treatment, i. e., the cure could not be attributed to this one mode of treatment. Even in this case, the inhibition gave relief. We have observed the effects of inhibition of this center in many cases of chill due to nervousness, onset of La Grippe or other infectious diseases, and to abscess formation. In all cases the treatment was distinctly helpful to the patient.

The Language of Pain.—Homeopathic medical practice notes variations in the character of pain, and uses these characteristics as indications for the administration of special drugs, as though a nerve fibre expressed a language of pain. To the osteopathic physician, it is sufficient that a nerve express a disturbance at some point of its course. This cry of the nerves calls for just one thing, remove the cause. Search is made for this cause along its entire course, and the course of its connections.

Osteopathic View of Pathology.—Another particular in which the osteopathic pathology differs from other schools of medicine is in the way we view varying conditions of a viscus. To the medical practictioner, simple gastritis is a vastly different condition from gastric ulcer. To the mind of the osteopath, these conditions differ in degree not in kind. The same organ, the same blood supply, the same nerves are involved in both conditions, therefore we treat these structures. Our dietetic treatment takes account of the differing activity of the stomach, but our manipulative treatment does not.

We apply this same method to all organs. Our manipulative therapeutics are based on structure more than on function.

Center for Gall Bladder.—The gall bladder lies under the anterior extremity of the tenth rib. In cases of gall stone the area of the tenth dorsal spine has been found to be sensitive. All of the structural and functional changes con-

nected with gall stones have seemed to center at this area, and along the tenth rib. Fig 81 indicates the center for the gall bladder at the spine.

A Case Report.—On October 20th, 1900, a patient was brought to the free clinic of the Pacific School of Osteopathy for our examination. "The ordinary questions as to history, symptoms, etc., were not asked until a thorough physical examination had been made. The general appearance of the patient was of one greatly emaciated by long illness. There was considerable sensitiveness at several points along the spinal column, but no apparent mal-position of vertebrae. Pressure on a level with the head of the tenth rib, right side, caused a painful sensation along the entire course of the tenth intercostal nerve; therefore our attention was called to that particular area. The tenth rib was found to be twisted and depressed, so that the upper edge of the eleventh rib pressed into the groove on the lower border of the tenth, which ordinarily protects the tenth intercostal nerve. Thus there was a constant irritation of that nerve. This irritation was reflexed to the spinal cord and thence over the splanchnic nerve to the gall bladder, liver, stomach and spleen. The history of the case, physical examination and afterward the examination of the gall stones left no doubt as to this woman's trouble. The cause of the gall stones was the irritation of the tenth intercostal nerve caused by the slight displacement of the tenth rib."

"Owing to the length of time this irritation had existed, the whole sympathetic system seemed to be excited. Stimulation of the pneumogastric nerve caused the patient to become unconscious—inhibited the heart—hence the treatment administered was to raise the ribs, replace the tenth, inhibit reflexes, and direct manipulation over the gall bladder."

"The fact that the treatment, as directed, acted immediately, shows that it was logical and scientific."

"We have no doubt there are other causes of gall stones, but this is something new to be added to the etiology of the disease. It does even more than establish a new etiological factor, it helps to establish the claim of the osteopath to a dis-

tinctive pathology, and a system of therapeutics based on anatomy and physiology."—Vol. IV, page 174, The Osteopath.

Intestines.—The small intestines are governed from the lower part of the splanchnic area, ninth, tenth, eleventh and twelfth dorsal. The large intestine is controlled by nerves from the lumbar region. There is a segmental distribution of these nerves to the large and small intestines. This segmental arrangement is exemplified in cases of diarrhoea. If the large intestine is the part affected, our manipulation is devoted to the lumbar region. Reflexes from the bowels may be found at any point between the ninth dorsal and the fourth sacral.

In five consecutives cases of appendicitis, the reflex was located at the third and fourth lumbar spines. Fig. 79 indicates the area concerned in reflexes from the large intestine.

Uterus.—The position of the arrow in Fig. 79 indicates the point of apparently close connection between the hpyogastric plexus and the cerebro-spinal system. This point is frequently the seat of great tenderness which is entirely reflex in character. All of the pelvic viscera at times send reflexes here. The uterus more than any other pelvic organ manifests its disturbed condition by tenderness at this point.

The uterus is such a changeable organ that it is the chief disturber of sympathetic rhythm in a woman's body. A change in its position causes a change in its blood supply followed by congestion of its mucosa. This congested condition sets up a series of impulses in the sympathetic system which may never reach the cerebro-spinal system. They spend their force on the various organs governed by the sympathetic nervous system, the heart, stomach, bowels, etc. Fig. 87 illustrates the difference in the heart's rhythm in the same patient. The first sphygmogram was taken while the patient had considerable difficulty in moving about on account of the heart's very irregular action. The uterus is prolapsed. Patient has worn a stem pessary for years. When the patient takes the genu-pectoral position and inhales strongly, while pulling upward on the abdominal muscles there is great relief, but when

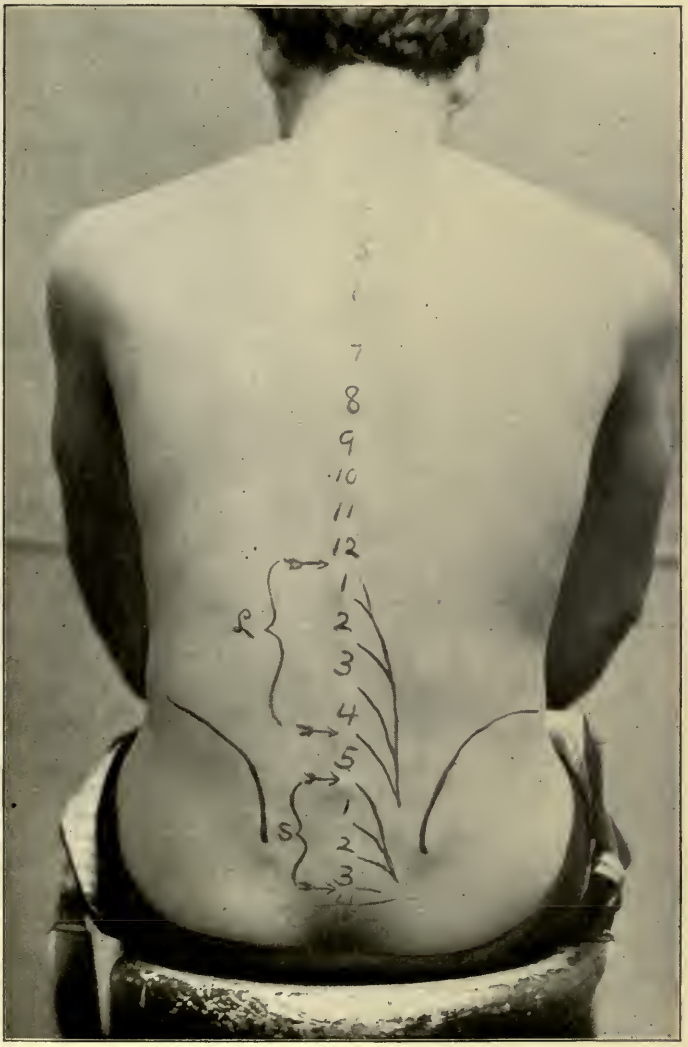


Fig. 85.—Areas of the lumbar and sacral plexuses.

the heart becomes as irregular as this sphymogram indicates, she is afraid to take this position. After twenty-four to seventy-two hours of irregular action, the heart regains its

rhythm. The position of the uterus becomes changed by the moving of the patient in bed. The perineum is badly torn and the uterine ligaments are greatly lengthened, hence the organ cannot be kept in one position. She has refused operation.

Many different points are named as centers for the uterus, but they all rest on the fact that after the organ has initiated a large number of impulses in the sympathetic system, they may be passed to the cerebro-spinal system at any point of union of the two systems.

Ovary and Testes.—These organs receive their sympathetic innervation from the plexus which lies on their arteries. The ovarian plexus is given off from the aortic plexus which receives fibres from as high as the eleventh and twelfth dorsal ganglia. Therefore a lesion in the area of the eleventh and twelfth spinal nerves is frequently in connection with the ovaries or testes. Fig. 82 indicates the height of the influence of the aortic plexus through its direct connection with the cerebro-spinal system.

Kidneys.—Fig. 83 indicates the surface marking of the kidneys and the junction of the last dorsal and first lumbar vertebrae. Lesions of either the eleventh or twelfth dorsal may affect the kidneys.

The reflexes of this organ may reach the cerebro-spinal system over the renal splanchnic. The articulation of the last dorsal and first lumbar allows considerable movement. It is probably the weakest part of the back. The area of the twelfth dorsal nerve is usually sensitive when the kidneys are affected. This sensitiveness may extend a short way upward, as far as the tenth dorsal.

In patients whose abdomen is moderately thin, it is possible to affect the renal sympathetic plexus by deep manipulation above the umbilicus. The kidneys lie above the level of the umbilicus. Have the patient lie in the dorsal position with flexed thighs so as to relax the abdominal muscles. The balls of the fingers of both hands should be pressed deeply into the abdomen about two inches above the umbilicus, then move the fingers laterally toward the kidneys. Pressure is

thus brought to bear upon the renal artery. The mechanical stimulation of the renal plexus usually results in vaso-constriction of renal arteries.

Second Lumbar.—The lumbar enlargement of the spinal cord is the physiological center for several functions performed in the pelvis. Defecation, micturition, and parturition, are all reflexly controlled at this point, second lumbar. The spinal cord ends at the lower border of the first lumbar vertebra. The second lumbar vertebra is indicated in osteopathic literature as a center for the three functions named above. We understand by this that an injury at this point may involve the functional activity of the rectum, bladder, or uterus. Disturbances in these viscera are not necessarily manifested to the osteopath by tenderness around the second lumbar vertebra. Any point along the spinal column below the second lumbar may be sensitive as a result of disturbance in the pelvic viscera. Fig. 84.

During parturition there is conscious aching along the whole lumbar area, thus demonstrating that the sensory nerves of the uterus can reflex their irritation to all the lumbar nerves. Injury of the spinal column at the junction of the dorsal and lumbar portions may affect motion, sensation and nutrition of all the structures innervated by the cauda equina. An injury below the second lumbar vertebra will not have as far-reaching effect as an injury of the same character above that point.

Paraplegia.—When the back is broken at the dorso-lumbar articulation, paraplegia results. It is not necessary to actually break the back in order to cause paraplegia. A severe strain, caused by a fall may induce such an exudate around this articulation that pressure is exerted on the lumbar enlargement of the cord. Many of the so-called broken backs, which are spoken of as causative of paralegia, are not broken at all, but the ligaments are badly sprained. The same condition exists here as in other sprained joints. There may be marked kyphosis, but this does not necessarily indicate dislocation. The paraplegic condition may be perpetuated by the pressure of connective tissue formed in the repair of the

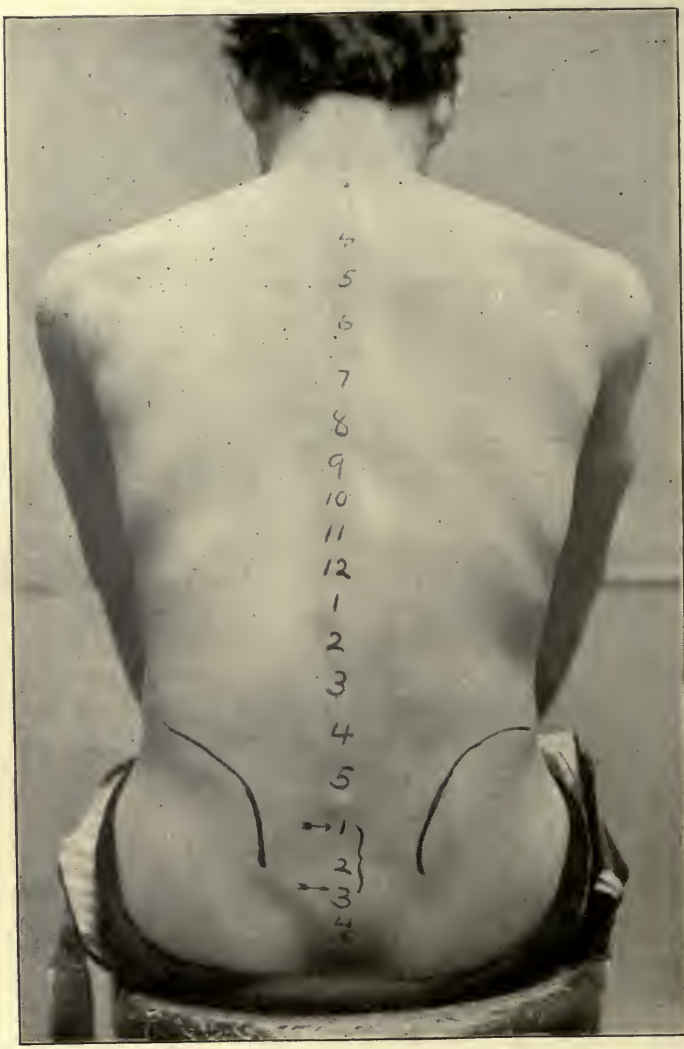


Fig. 86.—Center for the bladder.

injury. This is especially liable to follow if some form of manipulative treatment is not persisted in for from one to three years. The author has fortunately been able to observe

the slow regeneration of nerve tissue following complete paraplegia as a result of injury of the dorso-lumbar articulation. This case has been observed by us during nearly four years. During all of this time, she has received osteopathic treatment. This method of treatment was not begun until ten months after the accident, therefore, synovial adhesions had formed to such an extent in the joints of the limbs that much painful manipulation of these joints has been necessary.

Following the accident, there was motor and sensory paralysis of the extremities, bladder and rectum. Control of the bladder and rectum returned after two months' of osteopathic treatment. Sensation and motion have returned to the extremities. There is deformity as a result of the adhesions formed during the ten months previous to the first osteopathic manipulation. The patient had been massaged during the ten months mentioned.

Lumbar and Sacral Plexuses.—From the nerves of the cauda equina are formed two large plexuses, the lumbar and sacral, indicated in Fig. 85. The branches of these plexuses innervate the muscles of the lower extremities. The spinal area from which these plexuses receive their fibres should be carefully examined whenever any difficulty of movement or sensation in the lower extremities is presented.

The student should learn the sensory and motor distribution of each branch of these plexuses, so that peripheral disturbance can be immediately associated with the point of emergence, from the spinal column, of the affected nerve or nerves.

The Bladder.—Fig. 86 indicates the superficial area in which reflexes from the bladder are most frequently found. The sensory fibres to the bladder are found in the first, second, third and fourth sacral nerves. The first to third give the strongest evidence of sensory disturbance. When the mucous lining of the bladder is congested, these sensory nerves are stimulated. Motor fibres to the bladder are found in the second and third sacral nerves. The stimulation of the sensory nerves results in reflex stimulation of the motor nerves, which cause contraction of the muscular tissue of the bladder. In-

flammation of the bladder is accompanied by almost continuous desire to micturate.

The sacral spinal nerves take a more direct and uninterrupted course to the pelvic viscera than do nerves from other portions of the spinal column to their respective areas of distribution.

Inhibitory pressure over the sacral foramina has a very marked effect on the sensory nerves of the bladder. This pressure does not directly affect the anterior divisions of the sacral nerves, nevertheless the effect is the same as though the anterior divisions were subjected to the inhibitory pressure.

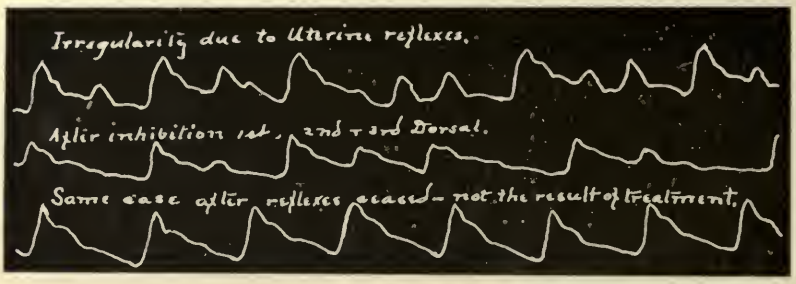

Irregularity due to Uterine reflexes.
After inhibition 1st, 2nd & 3rd Dorsal.
Same case after reflexes ceased - not the result of treatment.

Fig. 87.—Sphygmograms illustrating the effect of uterine reflexes on the heart.

This is evidence of the close harmony between the two divisions of a spinal nerve. The inhibitory pressure not only lessens conscious pain in the bladder, but also changes the vaso-motor conditions. In this respect it much resembles the action of heat applied to the surface.

Sphincter Vaginae.—The sphincters of the vagina and rectum are controlled from the area of the third and fourth sacral nerves. When the vulva, vagina or rectum are highly sensitive, we usually find a hyperaesthetic area at the third and fourth sacral spines. When this area is sensitive, the point where the pudic nerve crosses the ischiatic spine is also decidedly sensitive to pressure. Fig. 88 indicates the superficial relation of the pudic nerve. This nerve is sensory and motor to the skin and muscles of the perineum. This point will be found sensitive when the prostate is enlarged; in fact, almost any disorder of the male sexual organism is accompanied by this sensitive condition.

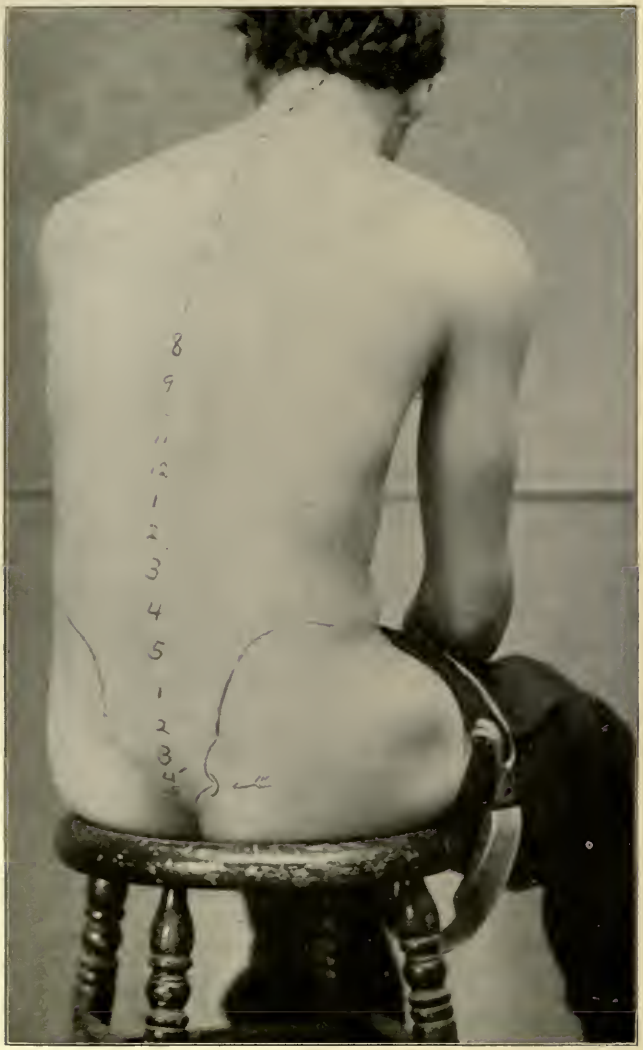


Fig. 88.—Surface marking of the pudic nerve.

Inhibitory movements over the back of the sacrum and ischiatic spine will result in relaxation of the perineal muscles. It affects spasmodic stricture of the urethra in a wonderful

manner. The local anaesthetic effect of inhibition is not so easily demonstrated in any other portion of the body as in this sacral area.

When the uterus is turned either backward or forward, or prolapsed there are impulses aroused in sensory nerve fibres in the rectum or bladder. These impulses are reflexed to the sacral area, while those aroused in the uterus pass to higher points in the spinal column. Inhibition of this sacral area will have a temporary effect. The only treatment worth while is the correcting of the position of the uterus.

Conclusions.— There are many more so-called "centers" mentioned by osteopathic writers. We have not attempted to even recapitulate those other centers which seem to us to be quite too fanciful for practical use. The centers mentioned in this chapter are those which can be demonstrated in daily practice, and hence are used continually, both as guides for diagnosis and as indications for the application of manipulative therapeutics. No sympathetic spinal centers for "sensation," "motion" or "nutrition" can be demonstrated. These are characteristics of nerve fibres in general, and it is entirely misleading to limit these characteristics to any one portion of the spinal column. Every osteopathic center should be capable of demonstration anatomically, physiologically and clinically. Only those which can pass this test satisfactorily are worthy of our consideration.

CHAPTER XII.

SYMPTOMATOLOGY.

The various symptoms which appear as the result of disease in the different tissues and organs of the body, when associated in fairly constant and well defined ways, have given rise to the use of names which designate these groups. A discourse on symptoms, symptomatology, has become a thoroughly recognized department of medical education. By too close study of these pictures of disease, the student

feels at a loss for a definite therapeutic plan unless he sees the symptom complex which he has been taught to view as an entity rather than as separate phenomena.

The basic principles of osteopathy do not lend themselves to the usual conceptions of disease as set forth in the works on symptomatology. The difference seems to be principally this: the older systems of medicine designate disease according to the tissues or organs involved, as, Diseases of the Digestive System, of the Respiratory System, of the Circulatory System, etc., while the osteopath simplifies this greatly by considering the disturbance in any tissue as being to some extent a manifestation of nerve disturbance, and therefore is most concerned with what may be disturbing "the master tissue"—nerve. Many of the names used to designate disease are excellent, since they describe with fair accuracy the state of the principal tissue or organs involved. They have become thoroughly incorporated in the popular conceptions of disease and are therefore hard to eradicate. They should not be allowed to befog therapeutics.

There is no doubting the fact that tissues and organs are primarily diseased, but more often the disease is a manifestation of disturbance of the nerve center or fibres controlling the part involved.

The Functional Activity of any Organ or Tissue is Proportional to the Circulation of Blood Which Nourishes it.—The more blood, up to a point where pressure interferes with function, the more activity. The blood pressure may vary considerably within physiological limits, but ischaemia or hyperaemia will result in loss or perversion of function. Severe functional disturbances may accompany these changes in circulation, but post mortem examination does not usually demonstrate their existence.

The liver may take on a state of physiological congestion in response to the presence of food for digestion when the food is especially difficult of digestion and more of it is ingested than the liver can take care of. The physiological congestion increases to a state of hyperaemia which occasions an

internal pressure with stretching of the capsule of the liver and there is decrease of functional activity. This hyperaemia may advance a step in severity and some of the elements of the blood pass into the perivascular tissues. If drainage is sufficient there will be formation of fibrous tissue at the expense of the gland cells. A slight decrease in drainage may cause the formation of pus, i. e., an abscess. These pathological conditions of the liver varying in intensity are due to changes in the resistence of the walls of the blood vessels. This resistence is under nerve control. Reaction may therefore be rapid, i. e., a normal state of the circulation may be quickly established as long as there is no infiltration of perivascular tissues. If new tissue or pus is formed a permanent change in the arrangement of the cell elements of the gland takes place and the body passes through a process of accommodation to new internal conditions.

There are many cases of severe functional disturbances where no fixed pathological condition has been reached. These cases get well rapidly because nerve control over the muscular coat of the arteries is good and no large amount of absorption of extravasated blood elements is required.

These changes in the liver may be duplicated in any organ or tissue of the body. The symptoms in any case will be increase, perversion or decrease in the functions of the organ or tissue involved according to the intensity of circulatory change. These changes may be directly observed in the tonsils and pharynx.

A hyperaemia, congestion, new tissue growth or abscess are comparatively the same pathological conditions whether they exist in a tonsil, the liver, kidneys, or central nervous system. The symptoms in any instance will be the functions of the organ or tissue expressed in a plus or minus manner and accompanied by signs of pressure, such as pain or the involvement of some correlated structures.

There does not appear to be any theoretical reason why the diseases of the nervous system should be any more

difficult to treat than those of any other tissue. In fact clinical experience proves that many diseases of this tissue yield quickly to osteopathic therapeutics.

The functions of the nervous system are dependent on the state of the circulation of the blood in that system although at the same time the control of the circulation resides in the nerve elements. With this nicely balanced condition of circulatory and nervous systems, subject to the effects of accident, environment and fatigue, it is astonishing disease does not more often become established.

The functions of the spinal cord are, (1) to conduct sensory impulses to and motor impulses from the brain; (2) reflex action; (3) contains centers which govern nervous action in tissues directly under the control of the sympathetic; (4) governs nutrition in all parts supplied by its nerves.

The functions of the spinal cord will vary according to the same law stated with respect to the liver, i. e., the functional activity of an organ or tissue is proportional to the circulation of blood which nourishes it. Since nervous tissue is in supreme control any change in its nutrition may manifest symptoms not only attributable to its functions of motory and sensory conduction but organs and tissues in any portion of the body may manifest disturbance of their own functions not due to their involvement but to the disturbed condition of their governing nerves.

With this comprehensive view of disease conditions it is possible to conceive of any disease of any organ or tissue being due to a change of circulation in some portion of the central nervous system or its distributing system of nerves. In other words we may say there are none but nervous diseases. In this sense every physician should become a specialist in nervous diseases. This does not mean that all diseases are of nervous origin, or should be treated from that standpoint, but it does mean that the study of symptoms should begin with a comprehensive understanding of the functions of nervous tissue and its

control of all the activities of the body. It is essential in diagnosis that we determine the location of the disturbance and its cause. This is the first step towards a cure. The examination of the spinal column, on account of its relation to the spinal cord should be made first.

Since we cannot demonstrate by post mortem examination the existence of hyperaemic conditions of the spinal cord, some clinicians think any reference to these states of the circulation which hang in the balance between a physiological and a pathological condition are but transcendental theories. The spinal cord, being so completely beyond direct examination in the ordinary condition we are compelled to judge of its involvement by the signs of its disturbed functions. Those pathological conditions of the spinal cord which are demonstrable by post mortem show changes comparable to degrees of congestion and inflammation in other tissues. Myelitis is comparable to tonsilitis. Both are inflamed conditions, but differing enormously in their effects on account of the vast difference in functions of the tonsils and the nervous system.

The causes of myelitis are of many kinds. Violence, either as a direct bruise or concussion; excessive contraction of the spinal muscles either in lifting or as an effort to keep from falling; exposure to cold; functional overaction of the cord due to peripheral stimulation, i. e., as a result of sexual excess, the myelitis being established at the point which gives origin to the nerves which are stimulated; toxic conditions of the blood, such as sometimes follow typhoid, malaria or diphtheria; also as result of fatigue products; poisons introduced such as alcohol, irritation and inflammation of viscera are mentioned by various authors of text books on nervous diseases. If causes such as those mentioned can produce either acute or chronic inflammation of the spinal cord with consequent destruction of tissue, it requires no stretch of the imagination to conceive of lesser degrees of congestion resulting from the same but less intensive causes.

Violence either extrinic or intrinsic, i. e., applied from

without or as an excessive muscular contraction is a prolific cause of primary structural lesions. The violence may be so intense that the structure is greatly injured and a congestion of the spinal cord will result. Examination of the injured part will show swelling, muscular tension, pain, heat and osseous deformity. In case the injury is severe enough to cause all these symptoms, the congestion of the spinal cord will be evinced by various signs of disturbance of the functions of the structures. The intensity and extent of the symptoms depends on the area and degree of congestion. After the congestion is established in the spinal cord, it usually affects the body profoundly and recuperation is practically always accomplished by loss of function in some degree. Nervous tissue being so highly organized structural loss is not easily compensated for and therefore the results of inflammation in any portion of it arouses our fears. If the same symptoms, swelling, muscular tension, pain, heat and deformity should appear in any joint other than those of the spinal area, physicians of all schools of medicine would probably apply hot or cold applications, elevation of the joint, compression and manipulation. When these symptoms appear in the spinal articulations with paralysis due to joint injury, it is seldom the condition is viewed or treated in the same manner as the more peripherally placed articulations. The symptoms of profound involvement of the nervous system seem to crowd all others into the background and hence the congestion is left to work destruction without hindrance. The fact that the nervous system is seriously involved should lead the physician to concentrate his remedial measures at the point of injury. The lesion is primary and the congestion which is to a great extent established for repairative purposes should be kept subdued if possible. A sprained spinal articulation is in no wise different from a sprained ankle, except that the swelling which accompanies the former is in a vital area and its pressure is profound and far reaching in its effects. Injuries of the spinal articulations may not be so severe as to cause congestion and inflammation of the spinal cord,

but may occasion an hyperaemia which affects its functions of visceral and vaso motor control. In such an instance the symptoms noted are not spinal but visceral and circulatory; in fact the spinal condition may be entirely overlooked being so thoroughly overshadowed by the peripherally manifested symptoms. These conditions of visceral disease are purely of spinal origin and must be treated accordingly. The lesion is spinal, structural in character, the primary cause of visceral disorder just as certainly as myelitis causes paralysis. In the light of these facts physical examination should begin at the spinal column.

Another cause of myelitis, exposure to cold, was noted. The influence of cold on sensory nerve endings in the back if at times sufficient to cause so profound a condition as inflammation of the cord can surely affect circulation less intensely if the conditions are less favorable. A less degree of spinal engorgement is conceivable and its effects on the functions of the cord just as sure as though it was brought on by violence. The local spinal symptoms of muscular tension with slight osseous deformity are generally present in palpable degree but the peripherally placed visceral and vascular symptoms conceal the true conditions except to the physician who is trained to reason from structure to function.

If the peripherally placed sensory endings in the skin can be so stimulated by temperature change as to cause profound congestion in the spinal cord, we should not be surprised that functional overaction of the cord due to excessive stimulation of nerves ending in mucous-membranes may result in the same pathological state. Sexual excess is the best example of this. The irritation and inflammation of viscera may at times occasion profound congestion of the cord but this is rarely the case. Head's law is noted in all cases of peripheral irritation affecting the spinal cord.

The toxic products of bacterial action in infectious diseases, food poisons, waste products due to fatigue, drugs, etc., which may be free in the blood stream irritate the nervous system centrally and peripherally and may oc-

casion congestion of varying degrees of severity. The spinal lesion accompanying such conditions is an objective symptom denoting the point of greatest irritation and is most often found at the area of the spine in nervous relation to the origin of the nerves controlling the organ most concerned in eliminating the toxic material from the system. The rational treatment in any such condition would be to hasten elimination by all means so as to save the organ showing the most involvement from injury.

Symptomatology viewed in this manner is not simply a study of named diseases, but rather the study of what nerves and blood vessels are involved in any diseased condition; where and how these channels of communication and exchange may be disturbed. The whole picture is one of anatomy, with the function of each structure borne in mind. In a great commercial enterprise a disturbance in a minor department of the business may not reach the general manager. This is not the case in the body. No disturbance is too trivial to be registered by the nervous system.

When the heart is primarily affected, intra-vascular pressure may be below the point required for good functioning of the nervous system. A condition of anaemia of the spinal centers due to this cause may be over looked. Anaemia on the one hand or moderate congestion may occasion practically identical symptoms. Therefore the general condition of the heart must be noted as well as the condition of local spinal areas. The peripheral symptoms may be due entirely to poor circulation.

The lesions, noted by Osteopaths, involving the spinal articulations are active factors in maintaining congestion however it may have originated. Therefore corrective manipulation is always an aid, if not at all times a necessary factor in the cure of the condition. This does not mean that visceral conditions due to direct involvement are not to be conscientiously attended to. Viewing disease conditions as just set forth, the physician can not help appreciating the fact that manipulation, hygiene and dietetics are

required in order to assist nature in correcting structural and functional defects.

Surgery is an ever present aid when the body no longer manifests sufficient power to react to simpler means of alleviation.

CHAPTER XIII.

THE GERM THEORY OF DISEASE.

The germ theory of the causation of disease has been so positively and persistently advocated, during the past decade, that any theory which is promulgated contrary to the popular view must, necessarily, have a foundation which is capable of withstanding the assaults of specific bacteriologists.

A large proportion of the data used to support the germ theory of disease may be utilized to show that the final therapeutic methods necessary to combat bacterial diseases are essentially osteopathic, i. e., natural.

Even those who have devoted their lives to the investigation of the life and activity of bacteria do not agree in their conclusions after observing the same phenomena. This is an evidence that bacteriology has not passed beyond the stage of historical tabulation. The amount of work done and the devotion of the workers speak well for the scientific spirit of investigation which has characterized the progress of this theory. The irony of it all is the fact that with the heaping of fact upon fact, and experience upon experience, it all proves that when we eat wholesome, nutritious food, in proper amount, labor sufficiently to promote a good circulation, sleep about one-third of the time, wear clothing which does not hamper cutaneous respiration, drink clean water and reside in well drained localities, we have those conditions which are conducive to a healthy life. This much we knew before, but we didn't know it scientifically.

Specific Causes—Then, too, bacteriology appeals to the human instinct to attribute diseased conditions to some

specific thing. In times gone by, disease has been ascribed to all sorts of mythical spirits, cabalistic signs, God's punishment, etc.

You will note by referring to Chapter II of this book that we have taken the broad view—essentially monistic of the cause of disease. The osteopath cannot view disease from any other standpoint. We must not substitute subluxations or muscular contraction for bacteria as the cause of disease. If we make this substitution, we are open to as much criticism as the specific bacteriologist.

Bacteriology as it stands today is the result of the study into the causes of spontaneous germination, fermentation and decay, and the origin of disease. Bacteria are plants of the lowest group. Bacteriology includes now, not only the study of these low forms of plant life, but also some low forms of animal life.

Bacteriologists have from time to time, classified these bacteria into groups according to form, method of forming spores, etc. These groups are much disturbed by the way in which the members change when grown in different media.

Conditions which Affect Life.—The first fact of great importance to us is that bacteria, like other forms of plant life, are greatly affected for their good or ill by their relations with other forms of energy, light, temperature, etc. It is as a result of experiment to determine the conditions best suited for life and growth of bacteria that we now understand processes of sterilization, disinfection, and the use of antiseptics. We have learned to destroy or modify the life of bacteria.

The next great fact is that the human body is a constantly changing collection of cells whose molecular constitution is also varying from day to day and hour to hour. The human body is a reservoir of energy with which bacteria come in contact. If the resistance of the body is sufficiently strong, the bacteria are either killed or reduced in power. The resistance of the human body is changed for good or ill according to its relations to other forms of energy, such as food, sunlight, etc.

Resistance.—We find that the intensity of the life of

bacteria and the human body are modified by their food supply and their environment. This being true, we are principally concerned with knowing what conditions are most detrimental to the life and growth of bacteria and the most exalting to the general resistance of the body. This is the scientific basis of hygiene.

The human body possesses certain powers which are capable of combating bacteria. These protective powers have been recognized and analyzed by bacteriologists.

We wish to call attention to the fact that Dr. A. T. Still stated, years ago, the physiological axiom that a perfect circulation of blood is requisite for health, recognizing, of course, that the blood must contain the proper food elements for the nourishment of the tissues.

Immunity.—Bacteriological researches have demonstrated this statement to be true. We will note some of the means whereby the body protects itself from bacteria. The term immunity is applied to that condition of the body which exists when specific resistance to bacteria is exhibited. Hankins' definition of immunity is as follows: "Immunity, whether natural or acquired, is due to the presence of substances which are formed by the metabolism of the animal rather than that of the microbe, and which has the power of destroying the microbes against which immunity is possible or the products on which their pathogenic action depends." In other words, immunity exists when tissue resistance is strong. Immunity is a quality of the body not of the bacteria. Immunity is sometimes inherited, a racial peculiarity, or is acquired by having the disease. It is claimed for vaccine virus that by causing the simple condition of vaccinia, the body resistance to smallpox is enhanced. Considerable work has been done along this line, but it cannot be said to be successful. It is an illogical and dangerous method of building up body resistance. Vaccination has a big task to prove an alibi in connection with many constitutional conditions following hard after it.

We quote as follows from Nancrede's Principles of Surgery, page 66: "Observers have extracted certain substances

—'defensive proteids'—from the livers and spleens of animals, capable of destroying bacteria. These are never found in normal blood; but when the febrile state has supervened, these substances in active state are detectable in the circulating blood. Blood serum is well known to be germicidal in virtue of the nucleinic acid it contains, dissolved out of or resulting from the disintegration of the Phagocytic leucocytes."

The relative immunity of certain races to the attack of certain diseases, for example, immunity of the negro to yellow fever, may prove that there is such a condition as inherited immunity, or it may simply demonstrate that the anapholes does not enjoy the taste of the negro's cutaneous excretions, and therefore does not prey upon him.

Some persons resist the attacks of bacteria for a long time, but finally yield. This condition has been explained by the results of experiments made on animals. An animal which is known to be immune to a definite bacterium, if fed on such food as will radically change the condition of its blood will lose its immunity. Fatigue will also destroy immunity. During and for some time after fatigue the products of metabolism clog the tissues, not only obstructing lymphatic circulation, but depressing the activity of the tissues, thereby lessening the general circulation and loading the blood with waste material. Hence, as a result of these experiments it is determined that immunity depends upon a perfect circulation of blood, i. e., blood containing proper food for the tissues. Nancrede writes: "The tissues then can only maintain their normal resistance by having an abundant blood supply; but this must move at a normal rate, in vessels of a certain calibre—although these conditions may vary within somewhat wide limits—otherwise germs will, for purely physical reasons accumulate in overwhelming numbers. Still further, if this blood does not move at a proper rate, it will not promptly carry away the poisonous products of cell metabolism, which will otherwise directly injure the cells. Again this poison laden, because sluggishly moving blood may incite the tissue cells to abnormal metabolism productive of toxic substances, even in the ab-

sence of germs, which when absorbed will produce most serious constitutional effects."

Since it is clearly recognized that hyperaemia lessens the resisting power of the engorged tissue, we can readily understand how hyperaemia of the intestinal tract opens the road to general infection of the body, or how the resisting power of any exposed structure, such as the lung will be lessened. Therefore, if we can lessen the calibre of blood vessels through the medium of vaso-motor nerves, the rapidity of the blood current will be increased and the resisting power of the tissues restored.

The phagocytic action of some luecocytes and fixed endothelial cells serves as a protection to the body. These phagocytes have the power to encapsulate a bacterium or spore and even in death set free nucleinic acid which is antiseptic .

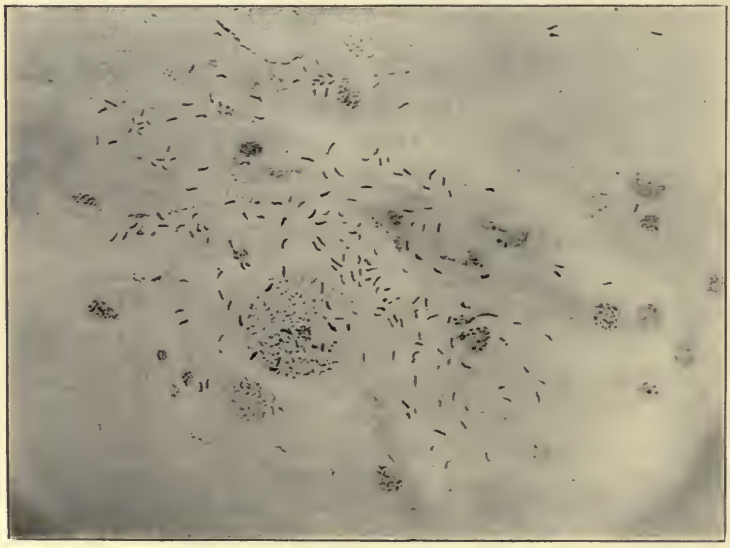


Fig. 89.—Tubercle bacilli in sputum. Photomicrograph made by J. O. Hunt, D. O.

Besides this power of a certain class of blood corpuscles to rid the system of bacteria, the liver, spleen, kidneys and intestines are active agents in eliminating toxins from the body. This indicates to us that we may assist nature in over-

coming bacteria by removing obstructions to the circulation, and by stimulating the eliminating organs of the body.

It is a well-known fact that one attack of certain germ diseases gives comparative immunity to the individual as far as future attacks of the same bacteria are concerned. It is on this fact that vaccination is based. It is true that an attack of typhoid fever gives a degree of immunity to future attacks of the typhoid bacilli, but it also gives susceptibility to the attacks of some other bacilli, i. e., the cells learn to resist typhoid bacilli, but not tubercle bacilli, hence if we depend upon immunity acquired by having a disease, or by innoculation, we may be immune only in a special way not strengthened in general tissue resistance.

Specific Treatment.—Physicians of all schools of practice have been imbued with the idea that specific treatment is the logical sequence of the discovery of bacteria. On this basis intestinal antiseptics were recommended for typhoid fever, and diphtheria antitoxin for diphtheria. The antiseptic treatment for typhoid fever has proved decidedly unsatisfactory. Drug medication aims to stimulate cell resistance. This method has proved unsatisfactory, although the object aimed at is the right one. The simple hydriatic measures employed by the early empirical hydropaths were so eminently successful that water is now recognized as the best means of stimulating cell resistance. Under this method the death rate of typhoid fever has been reduced to two or three per cent.

Diphtheria is the best example of the bacteriologist's specific methods of treatment. It is a well recognized fact that one attack of this disease does not confer immunity. Dr. Ferdinand Hueppe, Professor of Hygiene in the University of Prague, a bacteriologist, who has developed from that hotbed of bacteriologists, the Prussian Army Medical Department, writes as follows in his work on the Principles of Bacteriology: "Favorable specific effects, such as an immunity against living parasites and an habituation to their poisons, are often deceptive, if we fail to consider sufficiently the method of introduction or innoculation. A state of protection

by way of the skin may be present in cases where immunity does not exist at all to infection by way of the blood or brain; it may be present for one side of the body or for one extremity and be lacking in other organs. If this fact is forgotten then it may appear as if the influence of the body fluids were pre-eminent, but in reality the last word rests with the body cells. On this basis Schleich has very happily attempted to explain why diseases like diphtheria, that start from the membrane of the throat, or that start in the lungs, like pneumonia and influenza, or from the intestines, like cholera, confer upon the organism little or no immunity from another attack; it is because large tracts of cells remain exempt from the effects of the first invasion and therefore acquire no protecition. It seems as if, perhaps, toxic properties did not exist when in reality toxic manifestations are prevented only by chance. The alleged non-poisonous diphtheria serum itself, when introduced into the derma shows a toxic action which manifests itself in pains and in swelling of the joints and in the form of peculiar and obstinate skin affections at times like those of scarlet fever or measles, as well as in bleeding, kidney inflammation and paralysis, and it is very doubtful whether the list of possible injuries is yet exhausted, for perhaps other mischievous effects may come to light with other methods of use. Occasionally marked degeneration of heart, kidney and liver are witnessed immediately after the injection of the diphtheria serum; and this fact shows clearly that in the use of this antitoxin a danger exists of the same character as that displayed in Buschke's experience with the tetanus serum. If the action of the serum were simply antitoxic, danger of this kind ought to be impossible. We have a paradox of an antitoxin producing a toxic effect. According to Emmerich, animals that have been treated with diptheria serum afterwards succumb more easily to an infection with *Staphylococci* and *Streptococci,* a fact that points also to the poisonous action of the antitoxin upon the tissues. In man an acute outbreak of tuberculosis has been more than once observed to follow a serum injection."

Several specific methods of treating so-called germ dis-

eases have flashed on the horizon of medicine, but thus far none have proved generally successful, at least, the cures attributed to them are not lifted out of the realm of coincidence.

As long as the fact exists that many cases of diphtheria get well under osteopathic treatment, which is addressed primarily to increasing tissue resistance by maintaining a perfect circulation of blood, we are justified in using the manipulatory method, which is free from the dangers attendant on the administration of antitoxin.

Summary.—We have tried to show in this very general chapter on germ diseases that, (1) both bacteria and the human body, being living organisms, the intensity of life is modified by their food and their environment; (2) bacteria can be reduced in strength or killed by heat or chemicals; (3) when the bacteria are in the body, the use of chemicals cannot be specific, because the body cells may be adversely affected as well as the bacteria; (4) serum-therapy is not specific because it also is not without danger to the body cells; (5) the resistance of the body cells increases under the influence of favorable food and environment. Therefore, those methods which enhance general tissue resistance are the proper methods to use in the treatment of germ diseases.

The sanitary methods which are gradually being evolved for the betterment of our health are applied to those conditions which nurture and increase bacteria before they enter the human body. By decreasing the strength and number of bacteria on the one side and increasing the tissue resistance of our bodies on the other, we combine sanitation and hygiene in the most successful manner.

Mankind must not depend on osteopathy or any other system of medicine to guard him from the inroads of disease. True, we can ofttimes find a structural defect which has a bad effect on some particular function, but it is not sufficient to remove this defect and leave the patient to feel that he has no active part to perform. The only kind of inoculation we advocate is that which inculcates the idea of personal responsibility for disease. We quote again from Hueppe: "If a

person contracts a bacterial disease, tuberculosis for example, then, according to Koch, only the tubercular bacillus can be held responsible. It is just this belief that has made the science of bacteriology so popular in the eyes of the unreflecting multitude and of many easy-going physicians. We need no longer, it is supposed, be solicitous about our own mistakes and peccadilloes. Come what may, we are morally protected, and, secure in the consciousness of our individual merit, we now lay all responsibility upon 'the bacteria' as formerly upon 'catching cold.' A fatal blow is dealt to these self-deceptions and illusions by simply pointing to the fact that bacteria provoke fermentation only when they come in contact with fermentable substances under proper conditions, and produce illnesses and disease only when predisposition towards disease exists. Such liabilities of predisposition, we may either inherit from others or acquire by faults of our own. When no susceptibility to disease exists, we may harbor the bacillus with impunity. We should, then, revile the malicious bacteria no longer, but take ourselves to task and mend our ways. Not that, some measures of reform having been effected, we should behave ourselvse irrationally for eleven months in the year, then go to a medical Tetzel and have prescribed as indulgence a four weeks' sojourn at a watering place. It is better for the majority of men to put themselves, through sensible ways of living, into such a condition that bacteria can get no lodgment in their systems. This, in a few words, is the practical lesson of bacteriological discoveries, Koch to the contrary notwithstanding. It is the less comfortable doctrine, but it is scientifically more nearly correct than the other."

The purpose of this chapter will be amply fulfilled if it arouses the reader to pursue investigations, and study along the lines here laid down. We have not considered it worth while to recount here a long list of cases of bacterial diseases successfuly treated by osteopathic methods.

We may sum up our conclusions as follows: The blood contains the ingredients for overcoming bacteria. In order to afford the blood the greatest opportunity to exercise its antiseptic qualities, it must circulate freely and be fed properly.

The heart is controlled by nerves from a definite center, which is in connection with the surface. Large vascular areas are in close central nervous connection with the surface of the body, therefore, the anatomical and physiological factors are present whereby we may influence circulation by manipulation or other therapeutic methods affecting the surface of the body.

The eliminating powers of the kidneys and intestines can be effected by therapeutic methods applied to the skin and mucous membranes.

Therefore osteopathy treats germ diseases by removing obstructions to the circulation of the blood and to the eliminating power of the emunctories, and by attention to sanitation, diet and hygiene.

CHAPTER XIV.

ACCOMMODATION AND COMPENSATION.

Examination of patients frequently reveals the results of accidents or disease which do not appear to have any present deleterious influence on their health. It is always necessary for the physician to estimate the relations which these changes have, in the past, borne to the general health, or may at present, be liable to exert under known conditions of climate, diet and environment.

Definition.—In speaking of structural and functional changes, we use the words *accommodation* or *compensation.* Accommodation means "adaptation or adjustment;" histologically, "the occurrence of changes in the morphology and function of cells following changed conditions." Compensation means, "to make up for," "to counterbalance," "that which makes good the lack or variation of something else." The examples of accommodation and compensation are very numerous and it is necessary for the physician to be able to recognize the cases in which the body has exercised, or may, with proper assistance, exercise this power to a great degree. It is sometimes said that disease is an effort of the body to

accommodate itself to new conditions, that is, changes in the quantity and quality of stimuli occasioned by variations in climate, diet, environment or accident.

Osteopathy apparently originated from the fact that structure affects function. With this as a basis, all examinations are made from the structural standpoint and therefore if we follow this method too literally we are apt to overlook the fact that the cells of our bodies have the power of accommodating themselves to very pronounced changes in all those things which are considered essential to perfect functioning. Function in these affected cells may not be perfect, measured by their former activity, and yet apparently answer all the demands made upon them by the conscious or sympathetic life of the individual. There may be other cells, somewhat similar in character whose increased activity can compensate, that is, "make good the lack of" activity in the affected cells.

The Spinal Column.—The examination of the spine frequently reveals the irregularities in its structure. Disturbed function in some viscus or other group of tissues is sometimes attributed to this structural variation even when no direct nerve influence over the affected tissues can be directly traced to the spinal area. Mere change in structure cannot warrant us in considering it primary to a functional disturbance which does not exist in a location whose control can be traced to it. The effort on our part to *always* connect structure with function, having the relations of cause and effect, sometimes leads to very far-fetched reasoning. It is necessary for us to decide, in a given case, whether or no the present condition of the individual is as good as it can be made. Our decision will manifest to the keen observer whether we have recognized the extent of possible accommodation and compensation.

Curvatures of the spine present many phases which must be considered before treatment is begun. The curvature of an old case of Pott's disease seldom affects sympathetic life to the extent that we would expect. The very gradual progress of this disease seems to give ample opportunity for the structures in close relation to the diseased area to accommodate themselves to the changed conditions. It is hardly con-

ceivable that anyone would fail to recognize the accommodation manifested in these cases, and yet we have heard of those who advocated forcible straightening of the spine. The question to be decided is whether it is better to risk life by forcible straightening of the spine or endure deformity with fair health. Deformity is always a wound in the self-esteem of the individual. Many would risk life time and again to be rid of it. It is this which gives the experimenting physician or surgeon ample opportunty to try his skill or his ignorance. It is all one to the patient, a chance to be rid of deformity.

Compensatory Curvature.—A lateral curvature of the spine usually has two parts, the primary and the compensatory curve. The compensatory curve is the effort to maintain the erect position, that is, have the shoulders and hips level. The physician must determine which is primary and which is compensatory.

When the hip is dislocated or any condition exists which shortens one leg, the spinal column is curved to compensate for this reduced length. It would be useless to treat a compensatory spinal curvature without lengthening the leg by reducing a hip dislocation or putting an extension on the shoe. When the femur is dislocated, all the thigh and hip muscles accommodate themselves to a new position, then the spinal column curves to let the pelvis tilt enough to compensate for the lack of length in the extremity. The longer the dislocation has existed the more perfect is the accommodation and compensation. To reduce the dislocation we must undo the work of accommodation, that is, lengthen the muscles and force the head of the femur into the acetabulum. In cases of *congenital* hip dislocation it is questionable whether they can be reduced by the slow osteopathic method of relaxing the muscles. Accommodation and compensation are very pronounced in these cases. The acetabulum having never been used is practically non-functional. We have seen Dr. Lorenz demonstrate his radical method for the reduction of *congenitally* dislocated hips, but we are not able to give the final result because sufficient time has not elapsed. Judging from our previous personal examination of some of the cases

he operated upon, we are opposed to treating them osteopathically or otherwise. They were healthy, active children.

The Extremities.—Accommodation and compensation can be noted very quickly in many cases of injury of the extremities. A fixed scapulo-humeral articulation is partially compensated for by increased mobility of the scapula on the thorax. When the anterior tibial group of muscles is paralyzed the patient compensates for inability to raise the toe by flexing the thigh. When the hip joint is fixed in the extended position, the lumbar portion of the spinal column becomes very flexible.

The Thorax.—Drooping of the ribs lessens the antero-posterior diameter, but increases the vertical diameter. The full round chest of large capacity is usually less flexible and active than the small chest. The question in each case is whether the thorax is doing the amount of work necessary for the body.

All individual spinal lesions must be judged carefully as to their relations to functional disturbance. The fact that spines develop unevenly in many cases makes it hard to define their exact condition. A lateral subluxation may exist to which the body has become accommodated. To reduce this subluxation might again subject the individual to disturbed function.

Skin and Kidneys.—A spinal lesion might cause a disturbance in the functioning of the kidneys, decrease of activity, which in turn is compensated for by increased activity of the skin, which in time is compensated for by increased activity of the bowels. The diarrhoea in this case would be compensatory and yet it is very difficult for the physician to note this fact. If therapeutic means were used to stop the diarrhoea and the kidneys or skin did not immediately take up the work of elimination, the body would call upon the serous membranes and areolar tissue to take care of the surplus liquid in the circulation. As a result there would be edema of the extremities, ascites, pleuritic effusion. When all the serous cavities, pleura, pericardium, peritoneum and tunica vaginalis, and areolar tissues were well filled with liquid, even the

cranial and spinal cavities would be pre-empted, thus destroying the nervous tissue.

The compensating action which may take place between the kidneys, skin, mucous and serous membranes is one which is more frequently recognized and made use of by physicians than any other example of the same power manifested in the body. The fact that the skin and kidneys respond to each other's needs, forms the basis for many therapeutic procedures. Mucous membranes become active when the skin fails. Perspiration reduces activity of the mucous membranes. Serous membranes cease their excessive activity when mucous membranes eliminate freely. The oedema of areolar tissue gives way to activity of mucous membranes. The physician must recognize which is the diseased tissue and which is the compensating one. The failure of the kidney to excrete might not be the fault of its own structure, but result from the vis a tergo given the circulation by a diseased heart.

The Heart.—Compensation by the heart for some mechanical defect in it, is the most interesting subject studied by the physician. As a result of contraction of the orifices of the heart or faulty action of its valves, there is an increase in the size of one or more of its chambers. This increase is at the expense of the thickness of its walls, thus resulting in disproportion between the size of the cavity of the ventricle or auricle and the amount of muscular tissue required to empty them of their contents. When the proportion between the cavity and its walls is so far restored that the heart is able to overcome the stasis of the blood in that portion of the circulatory apparatus behind the lesion, we say that compensation exists. The ability to recognize the existence of a heart lesion is of great value to a physician.

Power of Encysting.—In this western country, California, we have ample opportunity to witness the ability of individuals to do hard, tedious work after a considerable portion of the lung has been diseased and expectorated. The healing which takes place under favorable climatic conditions, seems to leave the remainder of the lung in perfect functional condition. We have examined two cases in which the

whole right lung was destroyed and the heart had been drawn into the right half of the thorax. Both of these individuals were able to compete with their more perfect fellows for a living by doing hard manual labor. One of these patients had a discharging abscess in the axillary line between the ninth and tenth ribs. This abscess had discharged continuously for four years. The patient did not complain of a single symptom of ill health. He earned his living as a miner. This shows how thoroughly the system may become accommodated to very marked changes in the condition of its tissues. This abscess was in the man, but apparently not affecting his functions. Probably the abscess was walled off from the active body tissues by a protective membrane such as that which surrounds a tubercle in the lung and separates it from the healthy tissue.

The history of the lodgment of bullets in various portions of the body demonstrates that what cannot be thrown off by ordinary means may become encysted and thus not interfere with the activity of the tissues.

CHAPTER XV.

INHIBITION.

Acceleration—Inhibition.—We have noted in the chapter on irritable tissue that the attributes of nervous tissue are irritability, conductivity and trophicity. We may add to these acceleration and inhibition. We do not use the terms stimulation and inhibition as denoting opposite conditions, because stimulation applies to the initiation of an impulse. This impulse may be acceleratory or inhibitory in character. We may stimulate a nerve whose chief function is inhibition. An impulse whether acceleratory or inhibitory in character is the result of stimulation.

All bodily functions require stimulation, in the sense we have used the term, i. e., something must initiate an impulse which is designed to excite activity. After this activity is started, it must be governed. It is the means of governing these activities we are interested in studying.

It is not our aim to make an exhaustive study of the innervation of each organ in order to understand the manner of governing activity in them. Only the simplest and most useful points will be noted here.

Muscular Contraction.—Muscle may be stimulated to contraction. This contraction may be increased or decreased, thus showing that after the initiatory impulse starts on its way to the point of conversion into work done by the muscle it is accelerated, increased, or inhibited, restrained by certain influences which we cannot easily analyze. The contraction and relaxation phenomena of muscle are equally important. Vaso-constriction and vaso-dilation are examples of these phenomena.

Secretion.—The activity of secretory tissues is regulated by some arrangement similar to that controlling muscular action. After a cell becomes active it is still under the control of a governing center which accelerates or inhibits according to the necessities of the case.

Acceleration and Inhibition as Attributes of Nerve Tissue.—Cells are full of potential energy which needs a stimulus to start its conversion into kinetic energy. We may ask ourselves the question, Why isn't all of the potential energy converted into kinetic at one time or in response to a single stimulus? If the explosive material in a magazine is ignited it all explodes, there is complete conversion of potential into kinetic energy. There is no restraining or accelerating in this case. The element, nitrogen, whose liberation in this case causes such dire results, is the same element in the cells whose liberation is noted as "work" done by muscle or gland. Why isn't all of the nitrogen in the cells liberated by a single stimulus as in the magazine? We can think of no explanation except that impulses passing over nerves are qualified by other impulses passing over other nerves, the two stimuli of opposite character thus modifying each other, or in some cases, adding their forces when of like character.

Inhibition as an attribute of the nervous system does not seem to be exercised in short reflex arcs, neither does it appear to be exercised by centers in the spinal cord. It may be

that a certain amount of inhibitory influence is exerted in these subsidiary centers, but thus far investigations demonstrate this attribute to be possessed by the brain cells. Experiments on pithed frogs by members of my classes showed that stimuli, electrical or mechanical, applied to the spine called forth the fullest possible contraction of the extensor muscles. Every stimulation excited a veritable explosion of energy. The spinal cord of the frog functionates in a more independent manner than does that in man, hence if inhibition were an attribute of these spinal centers, we would expect it to be manifested in the frog. The strength of the stimulus seemed to have no qualifying effect on the strength of the contraction, i. e., weak or strong stimuli brought forth a strong response. Two matches will not cause a given amount of powder to explode harder than will one.

Is the Work Done, Proportionate to the Strength of Stimuli?—In therapeutics, we are compelled to consider the question: Is the amount of work done by muscle or gland proportionate to the strength or number of stimuli? We say, Yes! This answer is made as a result of observation and experiment, and our further consideration of the subject of inhibition will be from this standpoint.

Inhibition a Normal Attribute of the Central Nervous System.—Inhibition is a normal restraining influence possessed by the central nervous system. When the osteopathic physician speaks of inhibition, he means a therapeutic procedure which exercises a restraining influence over some function. This restraining influence being independent of that inhibition which is an attribute of the central nervous system.

Anything which decreases the number or strength of sensory impulses reaching a reflex center is inhibitory in character. The medical profession has made use of a large number of agents for this purpose, opium, for example.

Physiological Activity Is the Result of Stimulation.—All the functions of our body are initiated by stimuli. It must not be inferred from this statement that the author is satisfied that life consists of nothing but reflexes. So far as we can note the phenomena of muscle and gland, we are com-

pelled to recognize the fact that most of them are reflexes. Work done by muscle and gland is initiated principally by sensory stimuli. Excessive sensory stimuli excite increased work in muscle and gland, sometimes to the point of exhaustion. To decrease the amount of work, we must decrease the number of stimuli. The stimuli originate at the periphery of sensory nerves. Sensory nerves are most numerous in the skin, mucous membrane and muscle. Inhibitory influences must be applied to one or more of these structures. Skin is the surface tissue, richly supplied by sensory nerves, and under it are muscles also well supplied by sensory nerves.

Hilton's Law.—Hilton, by showing that the skin, muscles and synovial membrane of a joint, or the skin, muscles of the abdomen and contents covered by peritoneum are innervated from the same segment of the cord, laid a foundation for the rational use of inhibition in osteopathic practice.

Inhibition—Therapeutic.—Inhibition as a therapeutic procedure consists in a steady, digital pressure made over some nerve trunk, or over an area which is closely connected with a spinal segment from which nerves pass to an internal viscus which we desire to affect.

In order to explain the necessity for this movement and its beneficial effects, we must note the phenomena of vaso-motion.

How Vaso-motor Centers Act.—*Vaso-motor centers act according to the sum of the stimuli reaching them from skin, muscle, glands, etc.* If the sensory nerves of one lateral half of the body are stimulated, as by pricking with needles, the temperature of that half of the body will be higher than the other, thus demonstrating that excessive stimulation of sensory nerves ends in vaso-dilation, i. e., loss of tone of the muscular coat of the blood vessels. *Since excessive, i. e., over-stimulation of sensory nerves in this experiment causes inhibition of vascular tone and hyperaemia results, we argue that any procedure which lessens the excessive amount of stimulation passing to a vaso-motor center will favor the return of vascular tone.* Therefore since it is easily demonstrated that digital pressure lessens pain and sensitiveness in the area

pressed upon, we know that the registering power of these peripheral nerves is decreased, and there results a better vascular tone in that area.

Over-stimulation Equals Inhibition.—If over-stimulation results in inhibition of vascular tone, as the above experiment seems to demonstrate, then it appears rational to decrease the stimulation to a point where vascular tone is not disturbed. Digital pressure does decrease the irritability, therefore, we may express ourselves as follows: *Inhibition of sensory nerves, in skin and muscle, which are over-stimulated will favor the return of vascular tone in all areas which are supplied with nerves from the same segment of the cord.*

Over-stimulation of sensory nerves causes vascular dilatation. Inhibition lessens the irritability of sensory nerves and hence decreases the number of stimuli reaching the vaso-motor centers, thus allowing a return of vascular tone.

The Guide for the Use of Inhibition.—Knowing the complete distribution of any nerve trunk, we may judge the condition of the internal structures, supplied by one of its branches, by the physiological activity of surface tissues, supplied by others of its branches. In this way we are guided as to our use of inhibition.

Pathological Changes Which Accompany Over-stimulation.—If an individual eats a hearty meal and before it is digested eats another and continues the process, the stimulation of the sensory nerves in the mucosa of his digestive viscera results in a physiological hyperaemia which, under the ceaseless stimulation of the presence of food, finally becomes chronic. The liver becomes hyperaemic, and its sensory nerves are stimulated by the increased amount of blood present in the capillaries. These sensory nerves do not register their impressions on the sensorium of the brain, but do excite that area of the spinal cord with which they are connected by means of the rami-communicantes. This area of the spinal cord lies between the sixth and tenth dorsal spines. From this area nerves pass to the deep muscles of the back. These muscles are excited to undue contraction, and their sensory nerves are thereby made sensitive. The capillary circulation

in these muscles is poor, thereby increasing the muscular sensitiveness. This muscular sensitiveness, or rather increased stimulation of the sensory endings in the muscles sends a new set of impulses to the same area of the spinal cord, sixth to the tenth dorsal, and the cord reflexes them back to the sympathetic system. Thus a figure 8 is formed with the union of the circles representing the spinal cord. With impulses entering the cord from both loops, sympathetic and cerebro-spinal, the cord itself becomes hyperaemic. The constant interchange of reflexes which were originated by excessive demands on the physiological activity of the tissues involved, either ends in a spasmodic effort of nature to rid itself of the intolerable condition by means of a "bilious spell," or the hyperaemia causes excessive secretion of mucus, hypertrophy of connective tissue and atrophy of parenchymatous tissue. The bilious spell is nature's safety valve.

Rational Treatment.—After such a condition, as we have described, is well established, dieting merely lessens the reflexes in the sympathetic portion of our figure 8. The reflexes in the cerebro-spinal portion are still active, because the deep muscles of the back have become chronically contracted and continue to over-stimulate the sensory nerves. These cerebro-spinal reflexes still help to maintain the hyperaemia of the spinal cord which continues to disturb the rhythm of the sympathetic. Manifestly, the treatment must consider both portions of the figure of 8. Dietetics will lessen to some extent the hyperactivity of the sympathetic loop. Digital pressure, inhibition, will relax the spinal muscles and lessen the hyperactivity of the cerebro-spinal loop. The two lines of treatment will decrease the number of stimuli entering the segment of the spinal cord, sixth to the tenth dorsal, hence there will cease to go out from that segment a series of impulses which have tended to pervert the secretion in the digestive viscera.

The contraction of the spinal muscles may have subluxated a vertebra which then becomes a source of irritation. In such a case, a movement to replace the vertebra in its true relation acts in the nature of inhibition, i. e., it ceases to cause excessive stimuli to enter the spinal cord.

Digital pressure on contracted dorsal muscles causes sensitiveness, i. e., consciousness of the fact that the nerves in that region are abnormally irritable. The sensitive area along the spine will be in direct central connection with an internal viscus which is equally if not more sensitive.

Hyperaesthesia of Sensory Areas—Diagnosis.—The hyperaesthesia of sensory areas along the spine is of practical value for diagnostic and therapeutic purposes when we know their nerve connections. By inhibiting a hypersensitive spinal area, we set up a change in an area of low sensibility, i. e., a visceral area. The inhibitory pressure does not merely deceive consciousness by lessening the power of its informing nerves, which alone have power to stir up those reflexes which will tend to assist the diseased part to return to normal.

Results of Inhibition.—We know that inhibition lessens pain in the area of conscious sensation. The result of daily practice teaches us this.

Reflexes which are sufficient to cause pain are abnormal and tend to set up other reflex actions until the possibility of a return to normal action is greatly impaired. Example: Inflammation of the pleura causes muscular contraction in the muscles of respiration; the chest is held immobile and adhesion of the pleural surfaces results. Inhibition allows movement of the surfaces, thus overcoming the tendency to adhere.

Pain often sets up activities which are detrimental to tendencies of reparative reflexes.

Inhibition of painful areas does more than lessen pain; it aborts those impulses which are the result of pain, and sends a counter impulse into the center, which in a measure, negatives the original impulse. If this were not so, we could not stop vomiting, intestinal peristalsis or uterine colic. We know that inhibition of a sensory area of the spine not only stops pain in that area, but also pain, if there is any, in the viscus which is in central connection with it. Therefore, if we affect the tonus of both skeletal and involuntary muscles, sensation in the cerebro-spinal and sympathetic systems, we certainly affect the calibre of blood vessels and the activity of secretory and excretory glands.

It is not too much to say that inhibition does not deceive consciousness by lessening the power of registering nerves, but does stop a storm of reflexes which have no reparative tendency, and that it does affect the area of low sensibility, as is evidenced by a change in the condition of its musculature, blood supply and secretory activity.

There are many osteopaths who contend that the key-note of all manipulative work, according to osteopathic principles, is the discovery and removal of a "lesion," osseous in character. With this idea carried to extreme, the author has no sympathy. In connection with this idea the student is referred to the chapter on Subluxation, page 165.

The Phrase "Remove Lesions."—The phrase "Remove Lesions" is a good one, and yet it is inexact in many cases. It is an elastic phrase and capable of many and varied interpretations. Each year of active practice adds to the osteopathic idea of what lesions are. Our literature contains many references to lesions which are not mentioned in Dr. Still's writings, and yet Dr. Still's basic work has made the later conception possible. Osseous lesions have always been paramount in our work and thought, but muscular lesions now hold an equal place and bid fair to lead when we see more clearly into the subject.

The Human Body is a Vital Mechanism.—We say that "when the anatomical is absolutely correct, the physiological potentiates." This conception is based on the statement that the human body is a machine. The human body is vastly more than a machine. It is a vital mechanism, and the fact that it is vital renders it susceptible to other influences besides mechanical, such as falls, twists, strains, etc. We may truthfully say that when the physiological is over active, the anatomical alignment is disarranged. The principles of osteopathy as they were first promulgated declared that a structural defect is at the bottom of every physiological defect. Structure always affects function. A sufficient number of cases were found to give a foundation of fact to this statement. Hasty reasoning tried to make this an all-embracing principle applicable to every case of disease. Other schools of

medicine have made similar mistakes. The allopathic school promulgated the "law of contraries." The homeopathic school holds aloft the "law of similars." Neither of these are laws. A law is absolute, no exceptions are tolerated. If there are any exceptions to a so-called law, it ceases to be a law.

Structure vs. Function.—Structure affects function and function affects structure. Based on the first part of this sentence, we have the osteopathic subluxation theory. The latter half forms a basis for a legitimate use of inhibition.

This phrase, "remove lesions," is an osteopathic epigram. It has become so thoroughly ground into the mind of the student that he feels that no matter what the case, he must find a mechanical lesion and remove it in order to effect a cure. This is continually spoken of as especially scientific, and this feeling throughout the profession has headed off careful investigation in other phases of our work.

There certainly is a wide field for the rational and scientific use of inhibition as a therapeutic measure in the treatment of disease.

Osteopathic Meaning of Inhibition.—By the term inhibition, we do not attempt to convey any other meaning than that of pressure, applied at some particular point on the surface of the body for the purpose of lessening the hyperactivity or hyperaesthesia of the immediate or some distant part of the body. The inhibition itself does in some cases remove what we may choose to call a lesion, in other cases it may make the removal of a lesion possible, but in the majority of cases its effect is purely on the nerves, thereby acting on both the motor and sensory portions of the reflex arc, lessening muscular contraction and pain.

The Scientific Use of Inhibition.—It has been proven many times that the osteopath is capable of checking excessive functional activity in viscera by the simple means of inhibiton. Some would quibble as to the cause of this activity. The original stimulus may have disappeared, but the reflexes which it initiated may be perpetuating the condition. Many cases have been treated in whch no definite cause or osseous lesion could be discovered. Some of these cases came under the

heading, Indiscretions; others under purely *mental conditions.* These cases were treated by inhibition based on a knowledge of the anatomy and physiology of the parts involved. The treatment was successful. We are sure that such successes are just as gratifying, just as scientific, as are those in which the finding and reducing of a subluxation brings the glow of triumph to the eye of patient and physician alike.

Inhibition as a Local Anaesthetic.—Inhibition is a local anaesthetic, and as such is being used universally in the osteopathic profession today. True, it is not a treatment which will secure results in a minute. We can not inhibit for five minutes at the eighth dorsal spine in a case of malarial fever and expect to check the chill. The chill can sometimes be controlled as long as the inhibition is maintained. The influence thus gained over the muscular contractions seems to increase the patient's resistance. The onset of the next chill usually shows a decrease in the intensity of muscular contraction, and the duration is shortened. No one would say that we remove a physical lesion by this treatment. Muscular contraction of the deep dorsal muscles comes on with the chill, but does not cause it. Surely inhibition in this case works a nervous change of a pronounced character.

Inhibition May Act Without Removing a Lesion.—Inhibition for the vomiting of pregnancy in no sense removes a lesion, and yet it has successes to its credit, surely the inhibiting influence exerted on the stomach is great, for it is able to overcome the reflexes from the pregnant uterus.

The vomiting and purging of cholera morbus can be controlled by inhibition, and in this case there is probably an irritant to the intestinal mucosa in the form of indigestible food. The irritant is not removed by the inhibiton, but the excited stomach and bowels are given rest, and in consequence are able to carry on their functions properly.

An example of the good results of inhibition is afforded by one of the author's cases. Woman, fifty years of age, sufered from diarrhœa, two years duration. Five to seven bowel movements daily. No formed feces. Usually the stools were typhoid in character. Uterine fibroid removed prior to devel-

opment of diarrhœa. History of continuous drug treatment. Osteopathic examination did not reveal any osseous lesion. There seemed to be nothing to lay the blame upon, except the once existent fibroid or the result of the operation. Since no definite lesion existed, the treatment was planned as a test of inhibition without any other method. At the end of three months the patient had but one movement daily, and the feces were well formed. Pressure and gentle stretching of the muscles extending over the area between the eighth dorsal and fifth lumbar spines constituted the methods used. From fifteen to twenty minutes was the duration of the treatment three times per week for two months and twice per week thereafter.

In cholelithiasis the intense pain can be modified by inhibition at ninth and tenth dorsal spines, right side. Inhibition at this point also lessens the contraction of the abdominal muscles and thus makes direct manipulative treatment possible. The same is true in cases of appendicitis. We could not give direct manipulative treatment in such cases if it were not for the power of inhibition to lessen pain in the affected area and the consequent muscular contraction. How much more influence is exerted over the nerves of the appendix and surrounding region, it is hard to say. It may be that the inhibition arouses other forces of a stimulatory character to be brought into action to empty the appendix. Direct manipulation in these cases is frequently out of the question.

Inhibition to Remove Lesions.—Inhibition is a large and necessary part of many treatments given for the purpose of removing a definite lesion, for if inhibition were not first used, the true lesion could not be touched. This is the case in intestinal obstructions. The intestinal irritation causes such bowel contractions, cramps, and contraction of the abdominal muscles that the physician's fingers cannot palpate the disturbed area. Inhibition over the spinal area from which the nerves to the disturbed area pass out will cause relaxation of the muscles.

In a case of pleurisy which came under the author's care an opportunity was afforded to test inhibition unhampered by any other method. The patient could not bear to have the right arm moved; respiration was exceedingly shallow, and

the physical strength was very low. Hot fomentations had been used, but to lift the arm caused excruciating pain in the side. It was a case of dry pleurisy. Steady inhibition was given for fifteen minutes between the transverse processes on the right side in the area between the third and the seventh dorsal vertebrae. After this length of time the patient could raise the right arm above the head and take much better inspiration. As a result of this treatment given twice per day, the patient made a good recovery, though all the metabolic processes were carried on in a very unsatisfactory way.

Passive Movements vs. Rest.—According to Hilton's ideas, as expressed in "Rest and Pain," any movement of the chest muscles would be contra-indicated on account of the pain which would be nature's method of enforcing rest necessary for the cure. The patient declared that the deadening of the pain and the consequent possibility of movement of the thorax seemed to revivify the entire system, as well it might on account of the increased circulation and resultant activity of all vital processes. Hilton's theories are certainly well sustained by his argument, but when we consider that he calls adhesion of tissues a cure, we are compelled to strive for different results.

In chronic diseases one has ample opportunity to search for a definite lesion, but acute diseases usually demand rapid work, and one must be ready to meet the demands of the moment. It is comparatively easy to theorize about osseous lesions here and there in acute diseases, but only those who have had opportunity know what it is to attempt to set subluxated ribs or vertebrae in cases of pneumonia or appendicitis.

If, as Hilton declares, the use of local anaesthetics over the termination of sensory nerves which are reflexly irritable on account of inflammation in the area of distribution of other nerves from the same segment of the cord, is a good treatment, then the use of inhibition as applied by the osteopath is surely more rational and scientific.

Inhibition as a Preparatory Treatment.—There is still another time when inhibition is of incalculable value: In

making examination of the vagina or rectum, especially the former. Several times, in the author's practice, examination of the vagina seemed impossible without great distress to the patient. The irritability of the mucous membrane of the vagina caused intense spasmodic contraction of the sphincter, but steady inhibition over the third and fourth sacral foramina for about five minutes caused complete relaxation, and the examination could then be made without any trouble. Cases have been reported to the author by many osteopaths describing the good results of inhibition in gynecological cases. These cases have ranged from simple nervous vaginismus to curettement. Since the sacral nerves are so near the surface, and are not interrupted in their course to the pelvic viscera, they afford excellent opportunity for the good effects of inhibition to be demonstrated.

We know from experience that osteopathy can do wonderful work in removing obstructions, and that it comes nearer to finding all these obstructions than any other school of practice; but there are diseases not due to misplaced tissue. It behooves us to study how we can get results in those cases in which no physical lesion appears, and yet function is greatly changed.

CHAPTER XVI.

POSITIONS FOR EXAMINATION.

In order to be systematic in the examination of patients, it is well to adopt the use of a certain routine of positions which will best show the details of osseous structure.

Testing Alignment and Flexibility.—The first position, as illustrated in Fig. 90, flexes the spinal column and makes the spinous processes prominent. This position is valuable in examining even very fleshy people. Approximation or separation of the spines can be noted, also lateral deviation. If the amount of flesh over the spines, as in fat people, precludes the use of the sense of sight, you can ascertain the relation by the sense of touch.

Sense of Touch.—I wish to emphasize the necessity of

the students acquiring the habit of depending on the sense of touch, rather than of sight. In all osteopathic examinations, the sense of touch should be used to obtain those data concerning structure which form the basis of all diagnosis. Remember that you cannot see bone, muscles and glands, but you can feel them.

Fig. 90.—Flexion of the spine in the vertical position to make the spinous processes prominent.

Inspection.—While the patient is sitting erect, ascertain the flexibility of the spinal column. Note the position of the scapulae, whether near or far from the spinal column, whether unevenly placed. Note the development of the trapapezius, latissimus dorsi, and erector spinae, i. e., observe their surface markings.

Palpation of the Ribs.—Fig. 91 illustrates a method of bringing the ribs prominently into view, or in case of fleshy

Fig. 91.—Position to accentuate the prominence of the ribs.

persons, makes it easy to palpate them. By pulling the arm up and across the chest, the latissimus dorsi is stretched which brings the four lower ribs into a good position for examination. The movement of the scapula away from the vertebrae makes it easier for the examiner to feel the angles of the fourth and fifth ribs. It is not well to depend on this position for evi-

Fig. 92.—Palpation of the spine in the vertical position.

dence of rib subluxations, because the tension of the latissimus dorsi brings at least the four lower ribs into proper alignment. The spacing of these ribs will then be equal.

The chief value of this position is to give the examiner better opportunity to palpate the angles of the ribs above the ninth and to note the changed relations which may take place at the anterior end of the ninth, tenth, eleventh and twelfth ribs.

Palpation of the Spine.—After gathering as much information as possible by observing the form of the back, position of the scapulae and contour of the muscles, examine the spine by means of your sense of touch. To do this, have the patient sit erect, being careful not to exaggerate the normal posture, i. e., bend the spine far forward or backward in the lumbar region. A marked tendency to either position is indicative of weak muscles. Use the index and middle finger of either hand to carefully note the relations of the individual vertebrae, as in Fig. 92. Begin at the first dorsal and work downward to the sacrum. Lateral subluxations are easily noted with the patient in this position. Gentle digital pressure may be made at the prominent side of any subluxated vertebra to determine the degree of sensitiveness. This information is best secured when the patient is reclining, because the muscles are relaxed. While the patient is sitting there is usually too much contraction of both intrinsic and extrinsic muscles of the back to allow much examination outside of mere study of alignment and normal or abnormal curves.

Now have the patient recline on the right or left side, which is most convenient, as in Fig. 93. Examine the condition of the spinal muscles by using the ball of the fingers of one, or both hands. Be careful not to use the ends of the fingers. Commence your examination at the first dorsal by noting the amount of sensitiveness directly on or between the spinous processes all the way to the coccyx. To elicit this sensitiveness use a moderate pressure, equal to about six pounds. With this much pressure the patient will be able to distinguish easily between the sense of mere pressure and a painful or hyper-sensitive feeling.

Begin once more at the first dorsal and examine along the

sides of the spines and about three inches from them. This space brings the internal and middle groups of intrinsic muscles under your fingers.

Extrinsic and Intrinsic Muscles of the Back.—In speaking of extrinsic and intrinsic muscles of the back, we desire you to bear in mind the different groups as they are noted in Gray's Anatomy. Gray divides them into five layers. The first three layers are extrinsic, i. e., arise from vertebrae and insert into the humerus, scapulae, or ribs. They depend

Fig. 93.—Palpation of the dorsal muscles—horizontal position.

upon the intrinsic muscles of the fourth and fifth layers to fix the spine so that operating from the spinal column as a fixed point, they can move the upper extremities and ribs.

While palpating a back which is moderately well muscled, you will be able to feel through the upper three layers and distinguish the condition of the muscles of the fourth layer.

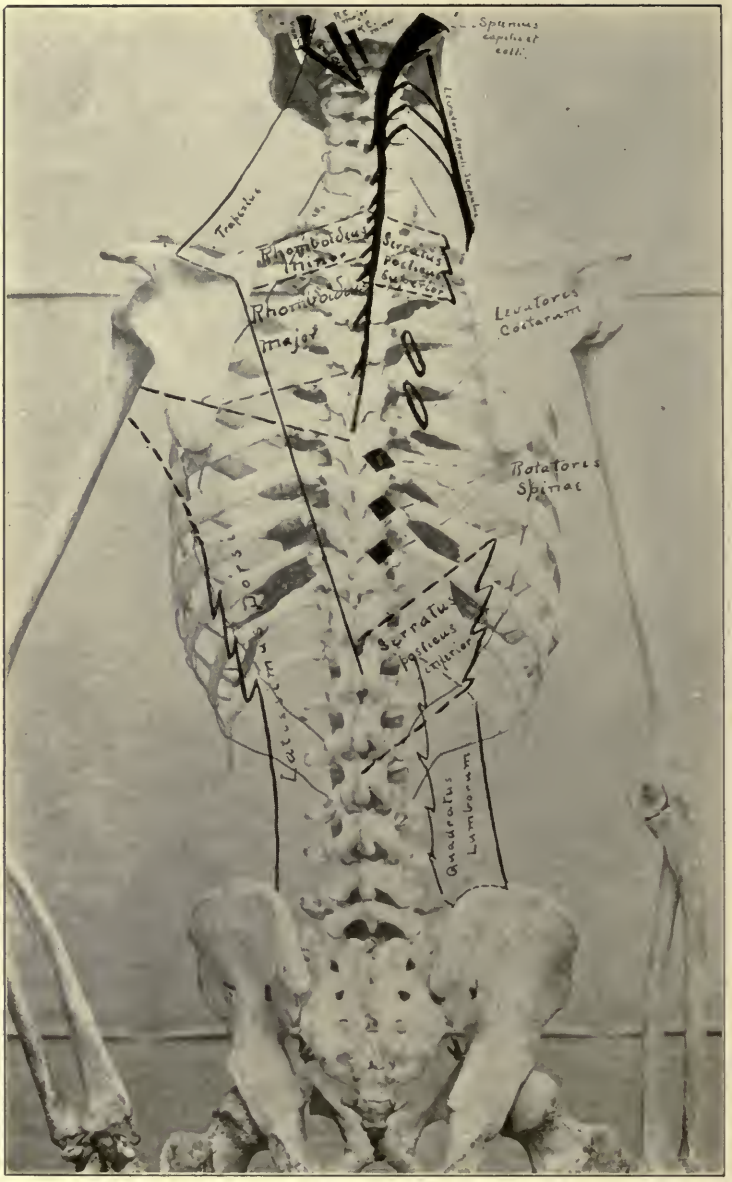


Fig. 94.—Diagram of dorsal muscles—1st, 2nd, 3rd and 5th layers.

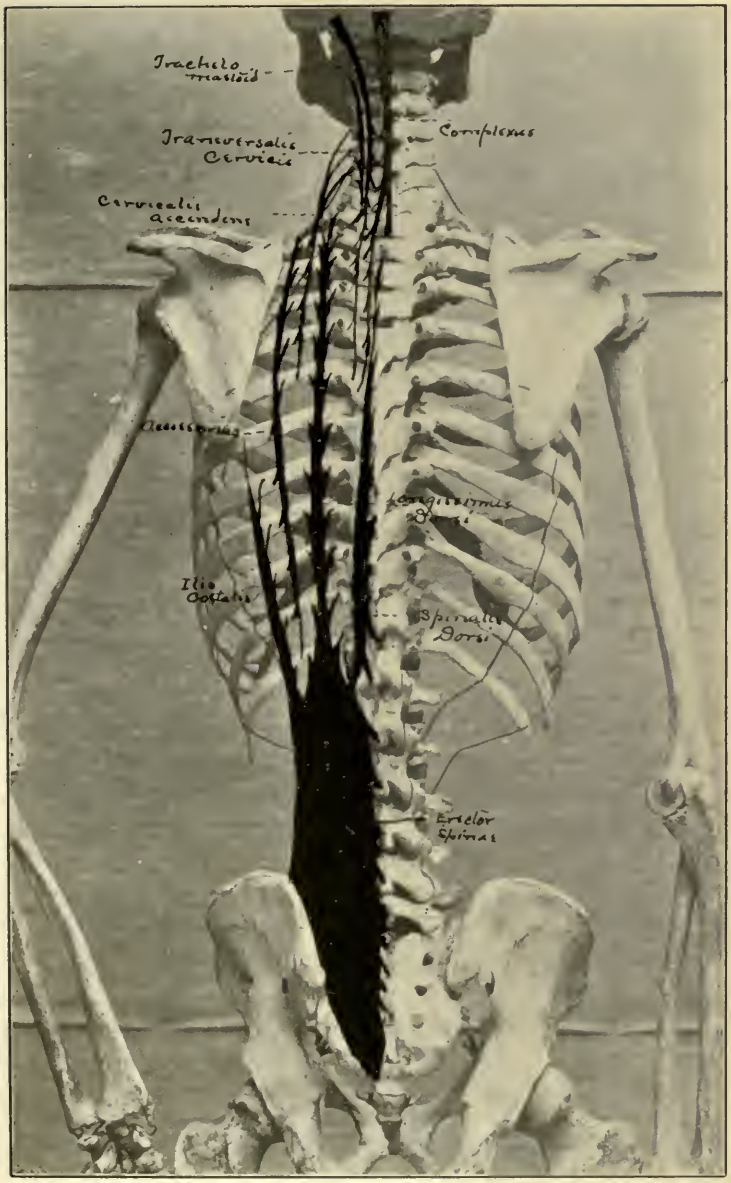


Fig. 95.—Diagram of dorsal muscles—4th layer. Adapted from a diagram in Cunningham's Anatomy.

It is important that the student should learn to feel through the soft tissues to harder ones below. Skill in detecting varying degrees of density and hardness is an absolutely essential qualification of the diagnostician.

A careful dissection of the fourth layer will disclose the fact that there are three parallel groups of muscles. The first is the spinalis dorsi which lies on the side of the spines. The second group lies more on the transverse processes. The longissimus dorsi and its continuations make up this group. The sacro-lumbalis and continuations make up the third group which lies on the angles of the ribs. Careful palpation will distinguish these divisions.

The Diagnostic Value of Hyperaesthesia.—Different points, along the line of the first group, which are hypersensitive may be evidence of direct strain of a single vertebral articulation, or the result of a visceral reflex, or even in sympathy with a rib subluxation which affects sensory nerves reaching the same segment of the cord from which its nerves arise. Hyperaesthesia directly upon the spines is found usually in connection with depression or elevation of the spines, not lateral subluxation.

Hyperaesthesia at points in the second group of muscles, i. e., the longissimus dorsi and continuations over the transverse processes, may result from vertebral or costal subluxation, or muscular contraction caused by visceral reflex.

When this excessive sensitiveness is found at the angles of the ribs in the short muscular divisions of the sacro-lumbalis and continuations, it nearly always signifies an irritation from a costal subluxation.

The examination of the ribs should be made while the patient is in this reclining position. The fingers should follow the angles of the ribs, noting the spacing, special prominence or depression of an angle, then noting the compensatory changes at the chondro-costal articulations. In this way the relation of the ribs to each other can be determined.

When pain exists at any one of the points named, or the digital pressure arouses a painful reflex, all of the sensory points along the course of the spinal nerve should be tested in

order to determine the extent of the nerve irritation. Take for example, the point on the spinal column between the fifth and sixth dorsal. After examining these two spines and finding them well placed, our digital pressure at the sides might cause a painful reflex, i. e., the patient might complain of our pressure. Then we test the point over the transverse processes and angles of the ribs, and even the junction of the ribs and costal cartilages. If hyperaesthesia is present at all points in the distribution of the fifth spinal nerve, we understand that the original irritation may be slight, but long continued, or strong and of short duration. If no osseous displacement is discoverable which has a relationship with a hypersensitive nerve, we must look for evidence of disturbed functioning by the viscus most nearly related. The original irritation might have been an excessive demand on the ability of the viscus as in the case of the stomach being overloaded.

In any case, the discovery of what appears to be an osseous lesion, leads us to test the condition of its related nerves. If they do not show undue excitability, the lesion is doubtful as a causative factor. A careful examination of vertebral spinous processes may show many deviations from symmetrical development, and the diagnostician should guard against the false evidence of these distorted spines. If a spine has been distorted by unequal development, there should be no sensitiveness around it except as the result of a visceral reflex. In case of such visceral reflex, the examiner cannot help being misled as to the value of the apparent osseous malformation. His fingers cannot inform him that what he considers an osseous lesion is in reality bad development. The only way he can escape from making a mistake is by continuing his examination without holding a positive idea that he has found the cause. The history and development of the case may arouse strong doubts as to the value of his discovered spinal lesion.

Your attention is called to this possible mistake in valuation of a lesion so that you may not become wedded to the idea that when you have found what appears to be a mis-

placement, you are free to end your examination and pronounce a positive opinion.

Test Muscular Tension.—While the patient is on his side, examine carefully the amount of tension in these three groups constituting the fourth layer. After considerable education of the sense of touch, it will be possible for you to determine that the points under your fingers are probably too sensitive. When these muscles feel hard and unyielding, they are usually sore to pressure. The contractured condition of the muscle has affected the sensory nerve filaments in two ways:

Fig 96.—Testing the pliability of the interscapular portion of the spinal column.

First, by direct pressure between the contracted muscle bundles; second, by retention of metabolic waste products which result in chemical poisoning.

Thoracic Flexibility.—Fig. 96 illustrates a method of ascertaining the elasticity of the dorsal spine and thorax. This procedure assists in estimating the general condition of the body. If the thorax is fixed, inelastic, respiration cannot

be carried on properly. Oxygenation of the blood will be imperfect.

Examination of the Abdomen.—Fig. 97 shows the proper position of the patient for examination of the abdomen. The knees being drawn up allows relaxation of abdominal muscles. Where the abdomen is very sensitive to the touch, either because of pain or ticklishness, use the whole hand until the patient becomes somewhat accustomed to the touch. Sometimes it is necessary for the physician to lift the feet from the table and flex the knees quite close to the abdomen. A steady,

Fig. 97.—Palpation of the Abdomen.

even pressure of the hand on the abdomen will soon become non-irritating to the patient, and deeper palpation can be made.

If the examination is a general one, commence your work, with the patient in this position, by palpating the thorax. Note form and flexibility, especially the flexibility of the five lower ribs. The free movement of these ribs is essential to many

functions, chiefly respiration, but it also affords a sort of rhythmical massage to the liver and stomach.

Such observations of form and flexibility are very general, but they lead invariably to some clue of especial value in the search for effects and their causes.

Elevation or Depression of Ribs.—Note the spacing of the ribs to determine whether any rib is elevated or depressed. Palpate the chondro-costal articulations for misplacements, especially note the articulations of the tenth ribs, they are fre-

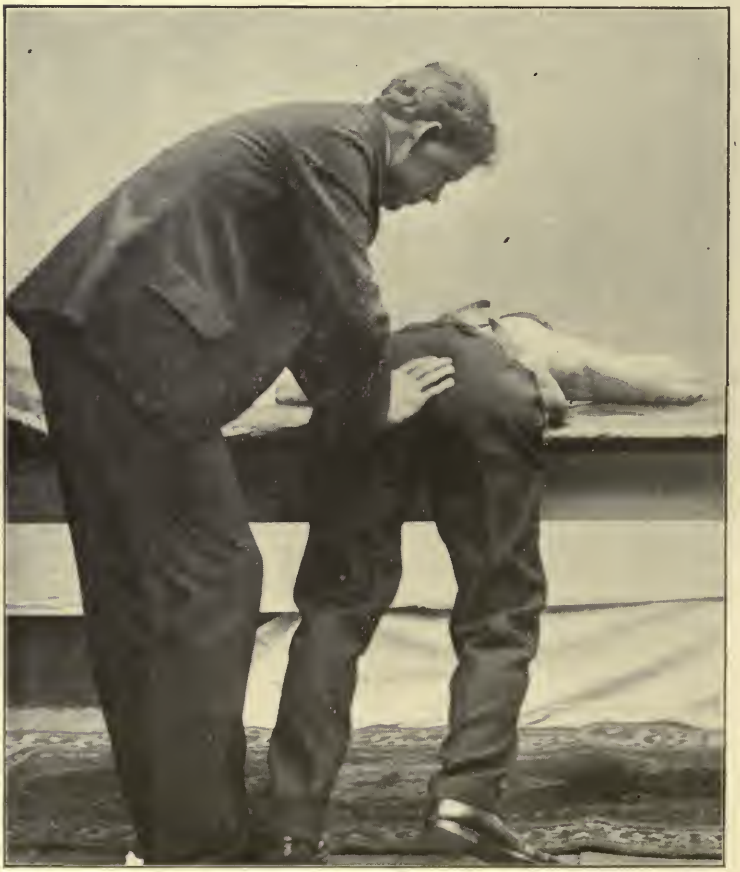


Fig. 98.—Position for examination of the prostate gland.

quently broken loose and form additional floating ribs. They are usually depressed slightly under the ninth.

After palpation of the chest, use percussion, then auscultation, according to the methods outlined in the best text-books on diagnosis. By the use of all these physical methods it is possible to arrive at a very definite conclusion of the state of the thoracic viscera.

The abdomen should be palpated, then percussed. These two methods should make evident any organic change in the abdominal viscera.

Fig. 99.—Simms' position.

Examination of the Rectum and Prostate Gland.—Fig. 98 illustrates a position for examining the rectum and prostate gland. Fig. 99 is the well-known Simm's position which may be used for the same purpose as the preceding.

Other positions used by the osteopath for examination and treatment are the well-known gynecological positions, genupectoral and Trendelenburg.

After the trunk has been examined in these various positions, the neck requires attention.

Examination of the Neck.—For easy examination of

the neck, the patient should be recumbent, as in Fig. 97. The muscles of the neck must have all tension removed so that the examiner's fingers can feel the processes of the cervical vertebrae.

A flat table instead of the model shown in the illustration is better. A hard small pillow may be used to support the head.

Since the spinous processes in the cervical region are short and bifid, and oftentimes developed unevenly and are covered with several layers of muscles and ligaments, it is not satisfactory to use them as land marks for relations of cervical vertebrae.

The tubercles on the transverse processes are easily palpated, hence these serve as guides in the detection of slight misplacments of cervical vertebrae.

The transverse processes of the atlas are usually large and sufficiently prominent to enable the examiner to ascertain accurately its position. When the atlas is in its true position, its transverse processes will be found about midway between the mastoid processes of the temporal bones and the angles of the jaw. This relationship may appear untrue when the mastoid processes are quite large or small, or the angles of the jaw are more or less obtuse. It is necessary to study the relative development and positions in every case, on both sides, in order to discover whether a subluxation exists. The fact that nearly all subluxations of the atlas are twists instead of direct forward or backward displacements, makes it comparatively easy to detect the inequalities and understand the faulty position. Sensitiveness will be found in the tissues on the side whose transverse process is posterior. In case there is marked sensitiveness on both sides, that is, on the posterior surfaces of both transverse processes, the atlas is probably drawn slightly posterior on both sides by the severe contraction of its attached muscles.

The third cervical vertebra seems to be easily subluxated. It is usually twisted, not sufficiently to lock its articular processes, but just enough to make the dorsal surface of its inferior articular process easily palpable through the muscles which

lie over it. This prominent point will be sensitive because the muscles over it are always tense.

Sometimes the sixth cervical vertebra is twisted. When this condition exists, there is marked disturbance of circulation in the head. The patient is usually wakeful and excitable on account of the congested condition of the cerebral blood vessels, caused by the pressure on the vertebral veins.

Note the tone of all the cervical muscles, the flexibility of the neck, the temperature of the skin on different parts of the neck. Palpate the chains of lymphatic glands, the thyroid and the submaxillary salivary glands.

After a thorough palpation of the neck, look carefully for any evidences of disturbed circulation in the head as may be evidenced by the appearance of the skin, mucous membrane of the mouth, the tonsils, conjunctiva or the wearing of glasses. Your knowledge of optics should enable you to judge the condition of the eyes by inspection of the glasses worn.

Such an examination of the head and neck as herein outlined should give the examiner a good understanding of the structural and functional condition existing at the time of examination, and even guide him to what other parts of the body may need special attention.

The History of Lesions.—All structural and functional facts determined by your examination are historical, that is, they have dates and circumstances which give them much or little value. The experienced diagnostician delights in filling in the life history of the patient to fit the structural and functional changes. Herein lies the opportunity for the physician to bring to his aid all his resource of experience and education in judging how these lesions have been brought about and how they are now influencing other tissues.

The Extremities.—While the patient is in the recumbent dorsal position, Fig. 97, the lower extremities can be examined. Note the comparative length of the legs, but be careful to eliminate all possibility of mistake by observing
11 whether the patient is lying evenly on the back, ilia same height, and muscles of both legs equally relaxed. A measure-

ment from the anterior superior iliac spine to the internal malleolus determines the length of the leg.

Palpate the great trochanter. Note its relation to Nelaton's line. These general directions for examination will determine the weak, disordered or diseased part of the body which requires your further careful examination.

Subjective Symptoms.—You will observe that thus far nothing whatever has been said about asking the patient concerning his or her subjective symptoms. It is a general principle underlying osteopathic diagnosis that objective symptoms are the only true facts upon which the diagnostician dares base his judgment and final verdict. The nearest approach to a subjective symptom thus far mentioned is hyperaesthesia. This may frequently be judged by the feeling of the muscle when pressed upon by the fingers. The muscular reaction to the painful sensory impressions occasioned by the pressure can be felt. Usually we depend upon the patient to indicate or corroborate our sense of touch.

In actual practice this process is not carried out in its entirety. Time is a factor in the physician's life as well as in the life of the business man. He cannot afford to go about his work in this detective-like manner. It requires too much time. We hear a great deal of objection to the physician's question to his patient: "What is your trouble?" But the answer to it enables him to get quickly to work on the seat of disease or at least leads him quickly to it. The physician who is a good questioner saves much time. He does not accept the subjective symptoms, merely goes to work to prove or disprove their verity by the standards of physical diagnosis.

CHAPTER XVII.

MANIPULATION.

After an examination has resulted in the location of a lesion, it is necessary to consider the therapeutic methods for correcting it. The lesions which are discovered may be osseous, muscular or ligamentous, resulting in the perversion of

some physiological process, such as an increase or decrease of blood supply or secretion, etc. The symptoms of the case are only surface evidence of disturbances of structure. The examiner must not be misled by symptoms; more than this, he must not let symptoms claim his whole attention when administering his therapeutics.

Methods of Procedure.—Osteopathic physicians frequently differ as to methods of procedure, but they all work according to the same principle. For instance, a subluxation of a vertebra might be discovered by two osteopaths. The first one might undertake to reduce the subluxation without any preliminary work on the muscles, believing that it is best to go right to the seat of trouble and remove it. His treatment would be severe because much strength would be required to overcome the resistance of the muscles governing the articulation. The second one might spend considerable time on the preliminary work of relaxing the muscles of the articulation, increasing flexibility, reducing sensitiveness, etc., before attempting any specific reduction of the lesion. The ultimate result of both methods would be alike. The question of which method is best lies wholly with the individual osteopath. Some like to put forth a severe effort for a short time, others a moderate effort for a longer time. Outside of the special choice of the osteopath, lies the business one of satisfying the patient. Severe work at the outset frightens some patients, furthermore, it actually bruises some of them. The ultimate result of the treatment may be excellent, but the patient does not quickly forget the methods used. There is a parallel between the immediate after-results of a severe osteopathic treatment and surgical shock. This shock should be avoided as much as possible.

The movements hereafter pictured and described are all made with reference to structure rather than function. Few references are made concerning their applicability to special diseases. We do not care what the name of the disease is. The groups of symptoms which make up the pictures described in symptomatology have very little significance to the osteopath. His movements are not made with reference to a named

disease, but to a faulty structural condition. The structural condition may be the basis for the physiological. Function does affect structure. We are not to lose sight of this fact. Function may be perverted by bad habits, hence our therapeutics must comprehend the hygienic and dietetic side of life as well as structural.

Each movement herein outlined secures a definite effect on a muscle, or is used to affect the relation of bony parts.

Fig 100.—Relaxation of the latissimus dorsi.

The movements made to affect the muscles of the back and spinal column are based upon the attachment of the muscles and the leverage they exert on the spinal column.

Relaxation of the Latissimus Dorsi.—The arrangement of the back muscles has been noted in the chapter on Positions for Examination. In order to relax these muscles in their

natural relations, i. e., from superficial to deep groups, we begin with such a movement as will separate the extremities of the most superficial muscles to their fullest extent. Fig. 100 illustrates the method of relaxing the latissimus dorsi. One hand extends the arm to its fullest extent, the other hand anchors the ilium. It will be noted that the lower dorsal and lumbar portions of the spinal column are lifted by the pull of this muscle. Also the four lower ribs are raised. The *intrinsic* effect of this stretching movement is to take most of the tension out of the muscle itself and increase the amount of metabolic change taking place within it. But that is not what is primarily intended. The intrinsic effects are mere incidents in the physiological life of the muscle, and as such are found following all kinds of muscular movements. The *extrinsic* effects are what concern us most; the effect upon the vertebrae and ribs, the change in the form of the chest.

There are three uses for this movement. First, as preparatory to work upon muscles lying beneath it, i. e., purely relaxing. Second, in case of overlapping by any one of the four lower ribs. It is a common condition to find the twelfth rib under the eleventh, or tenth under eleventh. The pull of the latissimus dorsi is exerted on all alike, hence the individual ribs are brought into their proper relations. Relaxation usually allows a return of the faulty position, but if the ribs are held at their extremities by the operator for a few seconds after relaxation, the intercostal muscles and quadratus lumborum will be filled with arterial blood which tones them. The patient should be directed to hang by the hands several times per day so as to get the good effect on the position of the lower ribs. Third, to affect lateral curvature of the spine in the lumbar or lower dorsal portion.

Relaxation of the Trapezius.—The trapezius is another of the superficial group of back muscles. Its fibres are so variously attached that several movements are required to relax all its divisions. Fig. 101 illustrates the method of grasping and holding the scapula while relaxing the trapezius. The scapula is rotated on the thorax as far as possible toward the head so as to stretch those fibres extending from the spine

of the scapula to the sixth and twelfth dorsal spines; then away from the head to affect the cervical fibres, then away from the spinal column to relax the short fibres between the upper dorsal spines and scapula. There is a vast difference in the way the scapula can be moved about in different cases. Those having any tendency to asthmatic trouble will present a very fixed scapula. The more marked the asthmatic condition is, the more difficult it is to move the scapula. Pleurisy and lung

Fig. 101.—Relaxation of the trapezius.

troubles, especially when coughing is frequent, tend to hold the scapula fixed. Lifting the patient's body above the table by the scapula gives instant relief in many cases of pleuritic pain, intercostal neuralgia or angina pectoris. This result is explained by the removal of the pressure exerted by the scapula when it is held too close to the thorax by contracted muscles

which are acting reflexly. A subluxated rib is usually responsible for the pains mentioned, but the muscles of the scapula are partially respiratory, hence act in connection with disturbances of normal rhythm of intercostal muscles. The pressure of the scapula helps to fix the whole chest in an unyielding condition. That which was at first purely helpful in character becomes in itself an added irritant.

Fig. 102.—Relaxation of the rhomboideus major and minor.

This movement or series of movements affects the tone of the muscle fibres, then the whole respiratory process.

Relaxation of the Rhomboids.—In the second group of back muscles we find the rhomboids, major and minor, accessory muscles of inspiration. Fig. 102 illustrates a method of

stretching these muscles. The patient's elbow is placed against the physician's abdomen. Pressure against the elbow forces the scapula back, and makes its vertebral border prominent. The physician's fingers grasp this border securely, and then lift steadily upward. This movement is excellent for the purpose intended. That which has been written concerning the trapezius is applicable to the rhomboids. Outside of the in-

Fig. 103.—Relaxation of the pectoralis major and serratus magnus.

trinsic effects on the muscle and on respiration, a slight effect may be exerted on a lateral curve in the interscapular region. It is generally used as preparatory to work on deeper structures.

The Pectoralis Major and Serratus Magnus.—Following these movements, where general thoracic and spinal relaxation

are desired, the movement illustrated in Fig. 103 may be used. It affects the Pectoralis Major and Serratus Magnus. By pushing the patient's elbow as far back as possible, the scapula is approximated to the spinal column, hence the serratus magnus is put upon a tension which lifts the eight upper ribs. The pectoralis major also affects the upper ribs. The physician's hand on the angles of the ribs accentuates the expansion of the chest. This is a general movement, but one

Fig 104.—Relaxation of the serratus magnus and some fibers of the fourth layer of dorsal muscles.

which has far-reaching effects upon respiration and circulation. It is adaptable to many specific structural defects of the ribs.

In Fig. 104 the physician again uses the humerus and scapula as means by which to affect the spinal column. The left hand exerts traction on the muscles above the spine, while the right hand and arm forces the patient's scapula toward the head and spine. The movement is made to enable the physician to relax the serratus magnus and some of the fibres of the

fourth layer of the back. Slight torsion of the dorsal spinal column is also secured.

Quadratus Lumborum.—The relaxation of the quadratus lumborum is secured according to Fig. 105. In all displacements of the twelfth rib, it is necessary to secure a free

Fig. 105.—Relaxation of the quadratus lumborum.

circulation in the muscles attached to that rib. The fact that it is a floating rib makes its position dependent on the tone of the muscles attached to it. It is frequently slipped under the eleventh. This movement separates them.

Fig. 106 is in some respects similar to the movement illustrated in Fig. 104, except that the scapula is forced downward, and the left hand is able to work through the relaxed super-

ficial muscles. After the use of the movements already illustrated, it is astonishing how easily one can work upon the fourth layer or examine the condition of deep structures.

Erector Spinae.—The work upon the fourth layer should be done according to Fig. 93. The fingers are placed between the muscles and the spines of the vertebrae and then drawn away from the spines in such a manner as to stretch the muscles. The fingers should never be allowed to slip over the muscles. Work steadily and deeply. Do not move the fingers over the skin. When you place your fingers, compel all soft

Fig. 106.—Relaxation of the lower fibers of the trapezius.

tissues beneath them to move with them. In this way you secure relaxation of the erector spinae and continuations, take out soreness of the muscles, and prepare for specific work upon the ribs or vertebrae.

The erector spinae is rarely contracted throughout its whole length. Your work should be centered on that portion which your examination has demonstrated to be contracted, either as a result of visceral disturbance, osseous subluxation, strain or cutaneous reflex from cold.

Having now prepared our patient for specific manipulation, we will note the results to be obtained on the general contour of the spinal column.

Treatment of Simple Kyphosis.—Fig. 107 illustrates one of the simplest methods of springing a spine which is kyphosed at the junction of the dorsal and lumbar. The physician's forearms are placed against the patient's shoulder and

Fig. 107.—A method of springing a dorso-lumbar kyphosis.

ilium while the fingers rest over the kyphosed portion of the spinal column. The hands draw forward while the forearms push away. Considerable force can be exerted in this way on slender patients.

Great force can be exerted on a posterior curve of the lower dorsal and lumbar portions by the movement shown in Fig. 108. This movement is also used for purposes other than

corrective of structural defects. Since the leverage is so great, it is quite easy for the physician to carry it too far. The result is an active congestion of the lower portion of the spinal cord followed by excessive activity of the nerve centers located there. In giving this movement to women, ascertain whether pregnancy exists. If so, do not under any consideration use it. The center for parturition might be excited by it, even though the movement made is slight.

There is practically no danger in this movement when intelligently used, except in the case of pregnancy. A slow,

Fig. 108.—A method of springing a lumbar kyphosis.

steady lift made while the physician is watching carefully the amount of resistance offered by the back will usually inhibit the excitement of the centers located in the lumbar enlargement of the spinal cord. The slowness and steadiness of the movement relaxes the muscles of the fifth layer and secures better drainage for the blood in the spinal canal. No active congestion is brought on, hence a sedative effect is gained. Quick, intense execution of this movement has frequently a reverse effect, because the sharp strain put upon the muscles results in added contraction, active congestion and obstruction to good drainage of the spinal canal. These conditions result in functional activity of those organs governed by the nerve-cells in the

lumbar enlargement. Active congestion of a center results in increased function of the organ governed by that center.

As a general rule, this movement is contra-indicated for any purpose but that of correcting a structural defect. The reaction of many patients is an uncertain quantity, hence it is not wise to use this treatment for purely functional effects.

As a result of the ignorant use of this movement by those who are palming themselves off as osteopaths, the author knows of several cases where dangerous conditions were brought on.

Fig. 109.—A method of springing an upper dorsal lordosis.

Lordosis—Upper Dorsal.—An anterior curve or straightened condition of the spine in the interscapular region is rather difficult to treat on account of inability of the physician to use the extremities as levers. Fig. 109 illustrates a method of applying leverage by means of the cervical vertebrae. The

position of the knee on the spinal column regulates the extent of the force of the movement. The knee is the weight to be lifted, the spinal column is a flexible lever. The physician's forearms are the fulcrum, while his hands apply the force to lift the weight (the knee) which bends the lever at the point governed by the position of the weight and fulcrum. The position of the physician's hands is important, because the cervical is not the portion of the spinal column we desire to bend. If the hands are allowed to rest close to the head, the force exerted is nearly all spent on the neck; the most flexible part of the spinal column is affected—a result not desired. Place the hands as nearly over the cervical and 1st dorsal spines as possible. Since the junction of the dorsal and lumbar segments is a very flexible point, the knee should be located higher.

The Possible Variety of Movements Which Will Secure the Same Results.—All of the effects described may be secured by movements differing from those outlined. The author desires to illustrate the application of osteopathic principles. It is believed by him that the series of movements illustrated have the virtue of directly and forcibly affecting the part desired without using up too much of the physician's strength in their application. Where much work is done by a physician, it becomes a vital problem with him how to conserve his own strength. By the selection of those movements which give the greatest leverage, he saves himself.

The Head and Neck as a Lever.—If the anterior or straightened condition of the spine is very marked in the upper dorsal, it is possible for the physician to use the head and neck in securing his leverage. When the position of the spine is as described, the spinal muscles in that area will be very contracted. The vertebrae will be held tightly together, thus lessening the flexibility. Loss of flexibility of the spinal column results in poor circulation in the spinal cord with consequent perversion of the activity of the physiological nerve centers located there. Congestion, passive type, usually exists around these centers when drainage is interfered with by these contracted muscles. The nerve centers manifest their irritation by such conditions as bronchitis, pleurisy, etc., that is, a congestion

exists at the peripheral distribution of the nerve similar to that at its origin.

Lordosis or Kyphosis May Affect a Function Similarly.—A change in the contour of the spine, either anterior or posterior, may result in the same disturbances in the peripheral distribution of the nerves from the distorted section. The anterior curve in the interscapular region usually causes the ribs to droop, which occasions a flat chest. The thoracic cavity is lessened, hence respiration is feeble. People with flat chests may develop wonderful breathing capacity by persistent exercise. The respiratory muscles lift the ribs. Exercise of these muscles will increase the antero-posterior diameter of the chest.

When directing a patient about the details of exercise to increase the breathing capacity, do not fail to impress the fact that a full round chest *without flexibility* is just as bad a condition

Fig. 110.—Voluntary treatment of an upper dorsal lordosis.

as an abnormally flat chest. Flexibility is the keynote of health. Those exercises which merely increase the contracting power of muscle, without at the same time increasing their relaxing power are not healthful.

Examination shows that whether we have anterior or posterior conditions in the interscapular region, the spinal muscles are contracted. The patient's power to relax them is lost.

The patient may feel tired and weak, but these muscles will not cease their contraction. The rigidity has passed beyond the patient's control.

The patient can do something toward restoring flexibility to an anteriorly curved or straight spinal column in the upper dorsal region. Fig. 110 illustrates the effect of flexing the neck forcibly by pulling down with the hands. These spines are greatly separated, and hence the muscles of the fourth and fifth layers are relaxed.

Fig. 111.—Use of the head and neck as a flexible lever to affect the upper dorsal region.

Fig. 111 illustrates how the physician can use the dorsal and cervical vertebrae as a flexible lever, and by shifting the position of the hand upon the spine apply the movement specifically to any particular vertebra. No movement which uses the arms as levers will affect the position of these vertebrae, be-

cause the first and second layers of muscles which are affected by arm movements do not control the intrinsic mobility of this portion of the spinal column. The fourth and fifth layers of back muscles are the groups which cause the mal-position of vertebrae in this region.

Splenius Capitis et Colli.—The Splenius Capitis et Colli, a muscle of the third group, extends as low as the sixth dorsal spine. As its name indicates, it is a bandage muscle, and binds down the muscles under it. Its long attachment in the dorsal region gives it a considerable influence there, when its superior attachments to the head and neck are forced an-

Fig. 112.—A method of affecting kyphosis in the upper dorsal region.

teriorly by flexion of the neck. It is the influence of this muscle which makes the movements described so effective. These movements are for a general corrective effect on a section of the spinal column. They are not well adapted to treatment of an individual vertebra.

Kyphosis—Upper Dorsal.—A posterior curve in the upper dorsal region can be treated by the method illustrated in

Fig. 113.—A method of affecting kyphosis in the dorso-lumbar region.

Fig. 112. The physician's right arm is placed above the patient's right shoulder and under the chest, so that the hand can be placed in the patient's left axilla. The patient's head should

Fig. 114.—A method of affecting kyphosis in the lower dorsal region.

be turned away from the physician, so that the upward pressure of his arm will not interfere with the trachea. The physician's left hand may be moved from place to place along the spinal column. The farther the hands are separated, the more leverage

is gained. Considerable force can be exerted in this movement without any danger to the patient, in fact to be of any value it must be made forcefully. The primary use of this procedure is to reduce the excess of posterior curve.

That which has been written concerning the nerve centers in the interscapular region when straightening or anterior curvature of the spine exists, applies equally to the posterior curvature.

Fig. 115.—A method of affecting kyphosis in the lumbar region.

Posterior curvature is accompanied by increased antero-posterior diameter of the chest, and loss of flexibility. This movement increases flexibility. It can easily be adapted to the treatment of the fifth or sixth ribs.

Kyphosis—Dorso-lumbar.—When the kyphosis is at the junction of the dorsal and lumbar regions, it is easy to

secure enormous leverage. The arms can be used as levers while the physician's knee rests against the kyphosis as in Fig. 113. If the patient's buttocks are held to the stool, the whole force of the leverage is spent on the back under the physician's knee. This movement should not be carried too far. It, like all other movements in which the physician has tremendous leverage, is liable to produce more than the desired effect. It stretches the thorax and abdomen very decidedly.

Fig. 116.—A method of affecting either lordosis or kyphosis in the lumbar region.

Contra-indications.—The author expects that all who use this and other high power movements, have examined their patients carefully before administering them. The presence in the abdomen of an aneurism, ovarian cyst, or gravid uterus, contra-indicate the use of any movement which compresses the abdominal contents, and also in the case of a gravid uterus any movement which is liable to cause active congestion of the lumbar enlargement of the spinal cord.

Other Movements.—Fig. 114 illustrates another method of exerting pressure on the prominent part of a kyphosis.

The leverage is not so great as in the preceding method, but where the kyphosis is slight, it is the better movement.

Still another simple method of springing the lumbar portion of the spinal column is shown in Fig. 115. The patient's knees are held against the physician's abdomen, while the physician's hands make counter pressure over the apex of the kyphosis. The buttocks are forced backward by the pressure

Fig. 117.—A method of securing general dorsal rotation.

on the patient's knees. Some osteopaths object to this movement or any other which necessitates pressure of the patient's knees or elbows against the abdomen. There is an element of danger to the osteopath.

This position, Fig. 115, is used frequently where strong inhibitory pressure in the lumbar region is required. For example, in cases of diarrhoea or cramps. Any hyperactivity

Fig. 118.—A case of uncompensated lateral curvature.

of structures governed by cells in the lumbar enlargement may be inhibited in this region.

When lordosis of the lumbar region exists, it is necessary to flex that region in order to counteract it. Fig. 116 illustrates an easy method of accomplishing this result.

This same movement with the physician's right hand under the spine can be made to do duty in correcting a pos-

terior curve. When the hand is placed directly under the kyphosis, the back is lifted; then if the buttocks be forced to the table, the spine will be sprung in the direction desired.

Dorsal Rotation.—Fig. 117 is a simple method of securing flexibility in the lower dorsal portion of the back. Rotation is possible in the dorsal but not in the lumbar region, hence, by holding the shoulders down and lifting one hip, rotation is secured in the dorsal region. This movement forces the normal action between individual vertebrae of the lower dorsal region. If any particular articulation is at fault, it will not yield to such a general movement as this. The only gain made by it in that case is to prepare the surrounding tissues for more specific work.

Lateral Curvature.—This kind of deformity is frequently found and a large proportion of such cases are benefited by osteopathic manipulation. These curves are developed as a result of improper sitting. A weakened condition of the whole body predisposes to the formation of a lateral curve. Fig. 118 illustrates an uncompensated lateral curve, that is, the curvature is all in one direction. In such a case the muscles on the convex side are not doing their full duty. The patient is allowing the weight of the upper portion of the trunk to be held by the ligaments instead of the muscles. This simple curvature can be readily overcome by exercises which will develop the weak spinal muscles.

Fig. 119 illustrates a compensated curve, that is, a letter S curve. The primary curve is in the interscapular region and is compensated for by a curve in the opposite direction in the lumbar region. This case is much more deep-seated than the previous one. This child was plump, but very weak. There were some symptoms of inflammation of the fifth, sixth and seventh vertebrae. This case requires manipulation which will twist the vertebrae in a direction opposite to their present tendency. The manipulation must be centered on the affected vertebrae. Extension of the spine will also be beneficial. Voluntary exercises should be taken gradually to strengthen the muscles.

Know How to Apply Principles.—The osteopath

should know how to apply his principles so thoroughly that the position of his patient, whether lying, sitting or standing, will not confuse him. Some osteopaths desire to give their manipulations to the patient sitting, others like the reclining position better. On the whole, it seems best to select the position suited to the special work required.

Do Not Copy Movements.—Do not copy anybody's movements. Learn the principles, then apply them in the

Fig. 119.—A case of compensated lateral curvature.

manner most satisfactory to yourself and helpful to the patient. To understand the principles and apply them intelligently, one cannot know too much concerning all the subjects which are the basis of a broad medical education. I do not mean by this that the student is to waste any time on drugs. From the osteopathic standpoint, drugs are not a part of the basis of a medical education.

CHAPTER XVIII.

REDUCTION OF SUBLUXATIONS.

Having noted a few movements which have a general beneficial effect on groups of structures, we will now examine a few of the movements which are applicable to specific subluxations.

In the chapter on Subluxation in the theoretical section of this volume, we called attention to the fact that "A subluxation is a slight abnormal relation between bony surfaces, maintained by uneven contraction in opposing groups of muscles which control the articulation. The causes of the contraction are violence, temperature changes, and reflex irritation. A reduction is secured by equalizing vital activity." With this statement in mind, we will study first the lateral subluxations in the dorsal region.

Lateral Subluxation.—A lateral subluxation is possible only in those portions of the spinal column where the formation of the articular facets allow rotation. The cervical and dorsal are the regions in which this occurs. Lateral subluxation is most common in the articulations of the atlas, third cervical, and anywhere in the dorsal with the exception of the twelfth. The inferior articular facets of the twelfth are lumbar in character, hence allow only flexion, extension and circumduction.

It makes no difference what the cause of the lateral subluxation may be, the uneven contraction of muscles is the final result, hence all are treated in the same manner.

When the vertebral spine is discovered out of line with those above and below and tenderness noted on its prominent side, we are disposed to consider it a true lesion, an irritant to the nervous system. Whether it is the result of accident, cold or reflexes does not need to be seriously considered. While it exists, it is a continual source of irritation to the nervous system, hence should be removed without delay. If it is the result of reflexes, its reduction will at least remove one disturbing factor from the case.

The prominent side of the spine is the one on which the muscles are contracted. The contracted muscles must be those which are holding the bone in its mal-position. In order to exert this influence, they must be attached in such a way as to move the bone in this direction when they act normally.

Fig. 120.—Surface indication of a lateral subluxation.

Their present condition is one of hyperactivity. With this line of reasoning, any articulation can be examined, the pull of its muscles determined and movements made in accordance with the normal action of these muscles.

In Fig. 120 we observe the subluxation to the left of a mid-dorsal vertebra. Intrinsic rotation of the dorsal spines is

the result of the contraction of the rotatores spinae, one of the fifth group. In order for this vertebra to remain subluxated, i. e., more rotated than any of its fellows, the particular digitation of the rotatores spinae attached to it must remain contracted after the other digitations have become relaxed.

Fig. 121. "Exaggeration" of a lateral subluxation.

The work laid out for us is relaxation of this one digitation. The digitation which is acting is working from below, i. e., arises from the transverse process of the vertebra below the one which is subluxated.

The first movement consists in "exaggerating the lesion." The patient's body is flexed laterally away from the prominent side of the lesion as in Fig. 121. This procedure stretches

the contracted rotatores spinae and also separates the three vertebrae, i. e., the subluxated one and the superior and inferior ones, thus making it easier to push the subluxated vertebra into its true position.

Fig. 122.—"Flexion" of a lateral subluxation.

The second movement is an anterior flexion to permit of greater freedom of movement between the articular processes. By forcing the body first into the position of lateral flexion, then anterior flexion, all the muscles of the fifth group which affect the subluxated vertebra are relaxed. During this anterior flexion, a "click" is sometimes heard which is evidence of relaxation sufficient to allow approximation of

the subluxated surfaces. During all the time of making these flexions, the physician's right thumb should make steady pressure against the prominent side of the spine, thus taking advantage of the relaxation gained by each flexion. The anterior flexion is illustrated in Fig. 122.

Fig. 123.—Extension and counter pressure-lateral subluxation.

The final movement is lateral flexion toward the lesion while lifting the patient from the stool in such a way that the weight of the body below the lesion exerts its influence to separate the vertebrae. Fig. 123. Counter pressure with the thumb is made vigorously during this final movement.

The successful reduction of this subluxation may be accomplished without any "click" or other evidence of movement of the surfaces. The vertebra usually moves into its true position without any audible sign. The physician's fingers can determine the success or failure of the movement. If the subluxation were caused by accident or cold, its reduction is all

Fig. 124.—Leverage applied to a lateral subluxation in the mid-dorsal region.

that is needed, but if it is the result of reflex irritation originating in a viscus, the physician must direct such a mode of living that rest may be secured for the stimulated viscus. Habits of life must be looked into.

Fig. 124 illustrates another method of reducing a slight lateral subluxation. The physician's left arm passes under

the patient's left axillary, then the hand is placed firmly on the base of the neck posteriorly. This gives the physician great leverage. The physician's knee, right or left, is placed against the spinal column at a point four or five inches below the subluxation. This compels the flexible spinal column to yield to the force applied at the neck, in such a way as to relax the deep muscles controlling the subluxation. Counter pressure applied to the prominent spine by the physician's right thumb completes the movement. By this movement about the same result is obtained as when counter extension is given by two men pulling at the head and feet of the patient, while a third one devotes his attention to forcing the vertebral spine into place. When the patient is short and heavily muscled, it is impossible to execute this movement satisfactorily.

Lateral Subluxation—Lower Dorsal.—A lateral lesion of the ninth, tenth or eleventh dorsal is more easily handled than those higher up, because the physician can grasp the patient in a much more satisfactory manner. Fig. 125 illustrates the method.

The series of movements are always the same as already described, that is, lateral flexion or "exaggeration," anterior flexion, then lateral flexion toward the lesion as illustrated by the cut.

With this same position, other forms of subluxation in the lower dorsal and lumbar regions can be corrected.

A Depressed Spine.—Slight depression of a dorsal spine with sensitiveness over it, that is, between its apex and the spine below, indicates that the muscles in that situation are sufficiently contracted to draw the spine of the upper vertebra downward. The depressed spine indicates that the body of the vertebra is slightly tipped backward and downward. See chapter on Subluxations.

To reduce this lesion, a flexion of the spinal column as far as the vertebra below is made anteriorly. If the depressed spine is any one of the upper six dorsal, use the pull of the splenius capitis et colli, i. e., flex the head and neck as in Fig. 12 11. The physician's right hand is placed on the spine of the vertebra below the subluxation, thus allowing all the force

Fig. 125.—Leverage applied to a lateral subluxation in the lower dorsal region.

of the movement to terminate in a pull on the muscles between this vertebra and the depressed spine. This same principle can be applied to all portions of the spinal column.

When individual spines are prominent, and sensitiveness is found above the process instead of below, we have a condition the reverse of that just described. Its treatment is sim-

ilar to that of the preceding, except that by changing the position of the right hand to rest upon the prominent spine, our leverage affects the contracted muscles above the spine.

Kyphosis—Pott's Disease.—Whenever a "knuckle" is found in the spine, inquire carefully as to the possibility of direct injury, predisposition to tuberculosis, etc. Pott's disease of the spinal column causes prominence of a single vertebral spine. As other vertebrae are affected, a kyphosis is developed.

According to the principles written by Dr. Hilton, in his volume on "Rest and Pain," there should be perfect rest in a case of spinal caries. His idea of a cure is ankylosis. The osteopathic principle is directly opposed to the idea of rest. As has been stated before in these pages, flexibility is the keynote of health, because a perfect circulation can exist only where free movement is maintained.

The predisposing cause of Pott's disease is a strain or bruise of a vertebral articulation which results in the hyperaemia of repair. Muscular contraction occurs as a reflex effort of nature to hold the parts quiet. This muscular contraction finally becomes a menace to the life of the parts which are being held by it, that is, it obstructs the free drainage of the injured part. Further destruction of tissue is favored by the lack of drainage occasioned by the loss of mobility.

There are many people with rigid, deformed joints who are living examples of the fixation theory as applied in surgical practice. Ten years is scarcely time enough in which to show a sufficient number of cases successfully handled according to osteopathic principles. Nevertheless, quite an array of cases can be referred to as evidence of successful application of principles of mobility.

The osteopathic work done on cases of spinal caries has demonstrated that when passive movement of the involved region is made, so as to free the venous circulation, the work of repair is immediately started. Time is the essence of the contract in such cases.

The author has seen cases of spinal caries in patients ranging from five to sixty years of age. The oldest was

treated with as much success as the youngest. When one has seen a patient sixty years of age suffering from spinal caries to the extent that standing or sitting without support of a plaster jacket was impossible, and the slightest weight of the body would cause the vertebrae to press the nerves of the lumbar plexus to such an extent that the pain became instantly unendurable; then to see this patient, after four years' of osteopathic treatment, able to ride a bicycle and the plaster cast thrown aside, one cannot be blamed for expressing enthusiasm.

I have examined but one child in the early stages of Pott's disease. It seems that little attention is paid to the actions of young children until the back becomes so weak and deformed that the child rests his hands on his thighs for support. Invariably a brace or plaster jacket, usually the latter, is applied to the child by the family doctor.

As to whether or not a brace should be applied is an open question to the osteopath. If all cases could be put under the care of an osteopath before the caries had involved more than one or two vertebrae, slightly, it is my opinion that a brace is useless. The passive movements will have a sufficient effect to start the process of repair in spite of the compression of the vertebrae by the weight of the body. In cases showing a kyphosis, involving several vertebrae, and where the patient cannot stand erect, but sustains the weight by the help of the hands on the thighs, we always apply a brace; a steel brace, not a plaster or sole leather jacket. This sustains the patient when exercising. The osteopathic treatment is a direct effort to secure flexibility in each vertebral articulation.

Examination should determine whether a collection of pus exists along the anterior surface of the vertebrae. If the kyphosis is in the lower dorsal or lumbar regions, examine carefully through the abdominal walls for the outline of a collection of pus in the sheaths of the psoas muscles. Note the length of the legs, condition of the hip joint, temperature of the spine, whether fluctuation can be shown under the origin of the rectus femoris. If much pus exists, the examination of these joints should show it.

If a pus sack is found, do not treat the case by using such heavy movements as might rupture the sack. In any case of Pott's disease, we do not attempt immediately to reduce the deformity; that is not the object of the treatment, and should not be expected. The object should be to stop the disease process and have it leave the tissues in such condition that the patient can move them. It is too much to expect the restoration of the destroyed bone to its original form.

I was called to examine a case of Pott's disease which had been treated osteopathically for six months previously. The patient showed marked signs of improvement during the first month. His sole desire had been to get rid of the deformity, hence he urged his physician to force the vertebrae to their normal position. With the help of an assistant this was partially done, much to the satisfaction of the patient. He stood straighter and walked better. This gain was only temporary, because the severity of the treatment started the pus to collecting in the sheath of the psoas muscle, and at the time of my examination had gravitated to a position around the hip joint. It had worked its way from the lesser trochanter to a position behind the greater trachanter. Fluctuation was present. I refused to treat the case. There was a fatal termination within a few months.

I always refuse cases in which a pus sack is clearly defined. Such cases are beyond control by manipulation. There may be osteopaths who are willing to handle such cases. I have not seen any successfully handled after the stage has been reached which has just been described.

Counter extension of the spine should be practiced by the patient's relatives at least every night and morning. Children should be compelled to rest at least twice a day, morning and afternoon. If a brace is deemed advisable, be sure it fits the patient well. Have it removed during the rest periods and at night. See that it does not cause abrasions of the skin.

I have noted here the good and bad effects of the application of osteopathic principles to this disease, so that the student may realize that each case must be examined with extreme care before any movements are made.

Fig. 126.—A method of spreading the lower ribs and stretching the diaphragm.

When adhesions are forming between the vertebrae as a result of the inflammation, the use of such movements as will force the normal movement of the joint are indicated. After a treatment is given which breaks up one of these adhesions, it is best to let the patient rest at least one week. Too frequent treatments keep up a continual irritation. If the patient is

not wearing a brace at all, or only a portion of the time, enough voluntary movement will be made to prevent the re-formation of the adhesion.

If a brace is being worn most or all of the time, treatments should be given at least three times a week in order to keep up the relaxation.

The movements outlined heretofore for the treatment of general spinal conditions, especially kyphosis, are applicable in the treatment of Pott's disease.

Rib Subluxations.—Rib subluxations present many difficulties to the osteopath. The methods used in their reduction are as varied as can well be imagined. A few of the most useful and direct are given here.

In Fig. 126 the physician is applying a method of spreading the lower ribs. When the tenth rib sinks under the ninth and there is a general jamming of the four lower ribs together, the physician stands behind the patient who raises his hands above his head to spread the lower ribs by means of the latissimus dorsi. While the hands are elevated, the physician grasps the anterior extremities of the ribs and holds them up while the patient lowers his hands to his thighs. Such a movement as this will replace the ribs in their right relations, but a flexion of the patient's body will undo the work. Continual well directed treatment and voluntary exercise are needed to bring them to place and hold them there.

The four lower ribs can be separated and the antero-posterior diameter of the thorax increased by the method illustrated in Fig. 127.

The left hand lifts on the angles of the depressed ribs while the patient's arm is extended beyond his head, thus making use of the leverage gained through the attachment of the latisimus dorsi. This movement increases the right and left hypochondriacal spaces.

The position of an individual rib is affected by the contraction of the intercostal muscles above and below it. The spacing determines whether the rib is elevated or depressed. The width of an intercostal space will not be the same between the angles and anterior extremities. This is caused by

the fact that the head of the rib is fixed so that it cannot move up or down. The movement which takes place between the head of the rib and the vertebra is a slight rotation. The costo-transverse articulation allows a slight gliding of the articular facet of the rib upon that of the transverse processes. As an example, take the fifth rib, when the space between it and the fourth rib is lessened by the contraction of the fourth

Fig. 127.—Spreading the lower ribs by using the latissimus dorsi.

intercostals. The lower margin of the rib becomes prominent because the rib is twisted when raised. The anterior extremity is depressed, making the fourth intercostal space wider anteriorly. Palpation of this rib in this condition will show a prominent angle with corresponding depression of the anterior extremity. When the rib is depressed at the angle, its anterior extremity will be prominent.

Palpation is the only method of discovering these sub-

Fig. 128.—First position to reduce a subluxated fifth rib.

luxations. To reduce them, the same principle we applied to reduction of vertebral subluxations must be applied here, i. e., the relaxation of the contracted muscles.

Fig. 129.—Second position to reduce a subluxated fifth rib.

The tendency in asthmatic and bronchitic patients is to cause elevation of the ribs, thus developing a barrel-shaped chest. When all the intercostal muscles act equally, the ribs are equally spaced, but in a case of bronchitis, some local por-

tion of the bronchial tubing is especially irritated. From this area, irritant impulses reach the spinal center with which it is most closely associated. The intercostal muscles in direct relation with this center receive a greater number of impulses, hence, contract more vigorously. A strain or blow might cause the same result.

To bring this fifth rib down to its proper position, the physician may stand behind his patient as is illustrated by Fig. 128. His left hand grasps the patient's right elbow and pushes it above the shoulder, thus causing the muscles to lift the ribs. This movement will pull on all the ribs of the right side, and tend to equalize the spacing. The physician places his left knee directly over the angle of the fifth rib, his right hand on the anterior extremities of the fifth, sixth and seventh ribs, the middle finger of this hand being applied against the lower margin of the fifth rib. The rib being now in right relation with its fellows, the critical period of the movement is when relaxation is allowed by lowering the arm. The knee above and over the angle, pressing forward and downward, while the middle finger of the right hand prevents depression of the anterior extremity. This leverage forces the rib to retain right relations with its fellow in relaxation of the chest. The termination of the movement is illustrated by Fig. 129.

A general depression of all the angles of the ribs causes their superior margins to be prominent. A flat chest is the result. This condition frequently follows pneumonia or some disease which causes the patient to lie on the back during a long period of weakness.

When a single depressed rib is found, it usually has been caused by a strain which has weakened the intercostal muscles in the space above it. Treat it while standing in front of the patient. Place the middle finger of the left hand under the angle. The patient's right elbow may rest against the physician's abdomen. Pressure made on the elbow forces the scapula back and brings into action the serratus magnus which lifts the ribs. Ask the patient to inspire and this will raise all the ribs. When relaxation comes with expiration, lift the angle of the rib forcefully, and it will regain its proper posi-

Fig. 130.—The position of the fingers below the angle of a depressed rib.

tion. Fig. 130 illustrates this movement. Some osteopaths grasp the patient's right wrist and extend the arm first forward, then above the head, and back to the side, instead of placing the patient's elbow against the abdomen.

It will be noted that all these movements are based on the effects of muscular contraction and relaxation with resulting

changes of the position of the structures to which they are attached.

Figs. 131, 132 and 133 illustrate the method of raising and spreading the lower ribs. With the patient in this position, the physician can make extensive passive movements

Fig. 131.—The first position in lifting a series of depressed lower ribs.

without much resistance. These movements are similar to that illustrated by Fig. 126.

When the ribs "droop" to a marked degree, there is a decided change in the shape of the diaphragm. The extent of the thoracic floor is lessened, and it may be that the structures passing through the diaphragm are detrimentally af-

Fig. 132.—The second position in lifting a series of depressed lower ribs.

fected by it. The movement pictured in Fig. 126 is well calculated to spread the lower ribs and thereby increase respiratory capacity.

The first rib is so strongly held by the scalenus anticus that it practically never is depressed. It is, however, frequently elevated to such an extent that it infringes on struct-

Fig. 133.—The third position in lifting a series of depressed lower ribs.

ures around the first thoracic sympathetic ganglion, thus affecting heart action.

To depress the first rib to its proper position, it is necessary to take the extra contraction out of the scalenus anticus. This is done by making the first rib a fixed instead of a movable attachment. Fig. 140 illustrates the method of relaxing the scalenus anticus. The physician's thumb holds the first

rib down while the muscle is stretched by forcing the patient's head directly to the opposite side. The scaleni muscles can be easily detected by placing one's fingers on the side of the neck near the base. They will be felt hardening during inspiration.

Luxations of the Innominate Bones.—Examination of the innominate bones requires very close observation of all the factors concerned in tilting the pelvis and varying the length of the lower extremities.

Fig. 134.—Position for treatment of an upward and forward dislocation of the ilium.

We have noted the immobility of the sacro-iliac articulations, in a previous chapter. Unless a decided accident has been experienced by the patient, it is hardly conceivable that the innominates and sacrum could have their relations disturbed.

All the cases of luxation of the innominate which we have examined in clinic and private practice presented a very vivid history of severe accident. The symptoms were principally those of pain, muscular tension and joint stiffness in the ex-

tremity on the affected side. Two cases of luxated innominate in females gave no signs of disturbed pelvic viscera, although we would expect decided disturbance in that region.

The only way to determine the condition of the innominates is by palpation and mensuration. Have the patient stripped and sitting in a perfectly upright position on a level surface. Determine the condition of the lumbar portion of the spinal column. Have the patient's shoulders level. While the patient is in this position the relative prominence of the

Fig. 135.—A dangerous method of applying force to the sacro-iliac articulation.

posterior superior iliac spines can be noted by palpation. Find the second sacral spine and note the relations of the iliac spines to it. They should all be on a level. See Fig. 54 in chapter VIII. Palpate for sensitiveness around the iliac spines, crests of the ilia and crests of pubes. Measure from the anterior superior iliac spines to the adductor tubercles on the internal condyles of the femur, when the patient rests evenly in the dorsal position. This measurement is not entirely satisfactory, because any change in the thigh muscles or hip rotators may easily vary the measurements. The only

fixed structures from which a reckoning can be made are the second sacral and posterior superior iliac spines. The relations between the sacrum and ilium are never greatly changed, therefore it requires the examiner to exclude practically all measurements which might be varied by muscular tension.

Fig. 136.—First position to raise the clavicle.

The posterior superior iliac spine may be less prominent than its fellow on the opposite side, or vice versa. There may not be enough upward or downward displacement to make a well recognized change in horizontal relations with the second sacral spine. This being the case, it is decidedly difficult to determine which side is normal and which is abnormal. Hyper aesthesia will have to be depended on to determine this

point. The related subjective symptoms of the patient will decide which is the affected side.

The shock which is transmitted to this articulation in an accident usually strikes the tuber ischii from below, or posteriorly, or strikes the knee and the force is exerted against the ascetabulum. When the force is against the tuber ischii

Fig. 137.—Second position to raise the clavicle.

from below, or posteriorly, we have an upward displacement, or a twist, causing the posterior superior iliac spine to become more prominent. When the force strikes the ascetabulum by means of the femur, the twist is in the opposite direction, and the spine is less prominent.

Have the patient give details, if possible, concerning his

position with reference to the direction of the force at the time of the accident.

Having determined the direction of the twist, the force of our manipulation must be made counter to that applied at the time of the accident. Since the hip joint is very movable, we cannot use the thigh as a stiff lever, therefore, our force must be applied to either the anterior or posterior surface of

Fig. 138.—Relaxation of the cervical fibers of the trapezius.

the tuber ischii and to the anterior or posterior superior spine of the ilium, i. e., push and pull, such as turning a wheel on its axle. This movement is illustrated in Fig. 134. The original force which this movement is trying to overcome, was transmitted from the knee by the femur to the acetabulum, and resulted in a twist of the ilum which made the posterior superior spine less prominent than its fellow of the opposite side. In order to make this movement effectual, an assistant

must make steady, even pressure over the articulation of the sacrum and fifth lumbar vertebra, i. e., overcome the tendency of the twisting movement to merely affect the movable sacro-vertebral, instead of the immovable sacro-iliac articulation.

By flexing the patient's thigh on to his abdomen, sufficient opportunity is given the physician to make pressure on the anterior surface of the tuber ischii, and pull forward on the pos-

Fig. 139.—Relaxation of the sterno-cleido-mastoid.

terior superior iliac spine, thus reversing the movement illustrated by Fig. 134.

Fig. 135 illustrates an effort to use the thigh as a lever to effect the sacro-iliac articulation when the posterior superior spine is prominent. This is a dangerous movement, and should not be used. The force transmitted by the thigh as a lever will not reach the joint desired, and will only result in straining the ilio-femoral ligament.

CHAPTER XIX.

TREATMENT OF THE CERVICAL REGION.

The treatment of the clavicles must be considered here, because their position so frequently interferes with the drainage of the tissues of the neck. When it is held down too close to the first rib by shortening of the subclavius muscle, it is

Fig. 140.—Relaxation of the scaleni by depressing the first rib.

quite sure to affect venous circulation in the head and neck.

To raise the Clavicle.—To raise it place the right thumb on the first rib as is illustrated by Fig. 136, then carry the patient's left forearm across his face above the head as in Fig. 137. Then as far outward as the physician's arm. This

movement causes the clavicle to press down on the physician's thumb, where it rests on the first rib, and thus stretches the subclavius.

Subluxation of the Clavicle.—Articulations, such as the sterno-clavicular and acromio-clavicular, which depend entirely on their ligaments to keep them together and to limit their motion, cannot be retained in place if their ligaments

Fig. 141.—Relaxation of the splenius capitis et colli.

have been injured. If the ligaments of the sterno-clavicular joint becomes relaxed, the pull of the sterno-cleido-mastoid lifts it upward. Slight irritation of the pneumogastric nerve may be occasioned by this change of position.

Preparatory Treatment of the Neck—Trapezius.—The preparatory treatment of the neck consists in movements to

relax the various groups of muscles. Fig. 138 illustrates the method of relaxing the cervical portion of the trapezius. One hand on the shoulder holds it firmly down, while the other hand forces the head as far as possible in the opposite direction. Relax the opposite muscle in a similar manner.

Sterno-cleido-mastoid.—Next, relax the sterno-cleido-mastoid by separating its attachments as far as possible, as in Fig. 139, also by direct manipulation. Observe whether both

Fig. 142.—Extension of the neck.

muscles will relax equally. These large muscles are frequently found unevenly contracted. Since the spinal accessory nerves control these muscles, any contraction should lead the physician to examine all parts in connection with them. A reflex from the laryngeal branches as well as pneumogastric branches might account for it.

Scaleni.—The scaleni muscles should be treated as already mentioned in Chap. XVIII. See Fig. 140.

Splenius Capitis et Colli.—Fig. 141 illustrates a method of stretching the ligamentum nuchae as well as all the extensor muscles on the back of the neck. This may be modified by forcing the chin backward with one hand, while the other flexes the head as sharply as possible. This stretches the muscles and ligaments on the posterior portion of the occipital-atlantal and axial articulations. The retraction of the chin governs the amount of stretching exerted by the flexion.

Fig. 143.—Position for circumduction of the neck to relax the muscles of the fifth layer.

Extension.—Direct extension of the neck makes an equal pull on all the vertebrae. When the patient's feet are anchored, the force of the pull is felt in the weakest portions of the spinal column. The average patient requiring this treatment enjoys a delicious stimulation after relaxation of the extension. A few who are extremely nervous may give a bad reaction. The influx of blood in the spinal cord is highly beneficial to those who have sufficient vaso-motor tone to hold

it there, but those who lack this tone will feel faint or even absolutely lose consciousness. Simply allowing them to rest on the table until the vascular system reacts, will enable them to reap the full benefit of the treatment. The extension should be made with absolute steadiness. The relaxation period is usually the one in which any vaso-motor phenomena are noted. The tension should be lessened very slowly in all cases. Fig. 142 shows the position of the physician's hands.

Fig. 144.—Relaxation of the stylo-hyoid and posterior belly of the digastric.

Rotation.—The following movement is one for which long practice is required in order to get anything like a successful result from its use. It consists in grasping the patient's neck with the left hand as in Fig. 143. The patient's head rests against and slightly to the right of the physician's forearm.

The right hand grasps the chin while the forearm rests firmly against the patient's head. The object is to hold the neck and head rigid above the point grasped by the thumb and fingers of the left hand. While holding the head and neck rigid, they are moved so as to force circumduction in the joint below the

Fig. 145.—Relaxation of the mylo-hyoid and hyo-glossus.

grasp of the left hand. After each circumduction the left hand is shifted the depth of one vertebra nearer the head. Thus all the intervertebral articulations in the cervical region are relaxed and specific work on a definite articulation can be done more easily.

The Hyoid Bone.—Work on the anterior portion of the neck consists in affecting the condition of groups of mus-

cles forming the floor of the mouth and extrinsic muscles of the larynx.

The Hyoid bone is the movable part which can be grasped by the physician's fingers. Drawing it downward and to the right, as in Fig. 144 relaxes the stylo-hyoid and posterior belly of the digastric. A contractured condition of these muscles may affect the pneumogastric nerve.

Fig. 146.—Relaxation of the crico-thyroid.

Mylo-hyoid and Hyoglossus.—The mylo-hyoid and hyoglossus forming the floor of the mouth may be treated as in Fig. 145 . When the maxillary glands are congested, it is necessary to relax these muscles. The physician's right hand grasps the hyoid bone, being careful to provide enough loose skin above the bone so that the force will not be exerted on the cutaneous tissues instead of the muscles underneath. After

the hyoid bone is pulled downward, the tension of the mylo-hyoid is increased by using the pressure of the fingers of the left hand.

Fig. 147.—Reduction of subluxation of the atlas—right transverse process too far posterior—exaggeration.

Sterno-thyroid and Sterno-hyoid.—The depressor muscles of the larynx and hyoid may be stretched by forcing these structures toward the angle of the jaw, while the free hand makes direct manipulation of the muscles. In all cases of congestion of the glands, mucous membranes or cellular tissues

Fig. 148.—Reduction of subluxation of the atlas—lateral flexion.

of the mouth, pharynx or larynx, these muscles should be relaxed if the position of the atlas has been corrected.

Intrinsic Muscles of the Larnyx.—The intrinsic muscles of the larynx sometimes need attention. The crico- thyroid

is the tuning muscle of the larynx. This may be demonstrated by grasping the thyroid cartilage with the thumb and fore-

Fig. 149.—Reduction of subluxation of the atlas—extension and counter pressure.

finger of one hand, while the thumb and forefinger of the other hand grasps lightly the cricoid cartilage, as in Fig. 146. If the cartilages are slightly separated while the patient makes a

vowel sound, the pitch of the voice will be perceptibly lowered. This is occasioned by relaxation of the vocal cords by separating the cartilages which stretch the crico-thyroid. This muscle is innervated by the external branch of the superior laryngeal branch of the pneumogastric. The motor fibres of the superior laryngeal come from the spinal accessory, hence we find lesions in the cervical articulations which are primary causes of laryngeal disorders.

Fig. 150.—Manner of holding the head and neck in order to reduce a subluxated sixth cervical vertebra.

The Atlas.—The atlas, on account of its position, freedom of movement, numerous muscular attachments, etc., is subject to frequent subluxation. Fig. 31 in Chapter VIII shows the normal relations of the mastoid process, transverse process of the atlas, and the angle of the jaw. Fig. 32, in Chapter VIII shows the abnormal relations of these various prominent points as they are frequently found by the osteopath. When the right transverse process is near the mastoid, the left is too close to the angle of the jaw, and vice versa.

In reducing this twist of the atlas, the physician should

work on the side which shows the transverse process to be posterior. The same principle is applied in reducing this subluxation as was described in connection with the dorsal lateral subluxations. Fig. 147 illustrates "exaggeration." Fig. 148 shows lateral flexion to the left, while the physician's fingers make firm pressure back of the prominent transverse process, thus steadily taking advantage of all the relaxation gained in each portion of the movement. The termination of the movement is illustrated in Fig. 149. Sometimes the atlas slips into place with an audible "click," but more often the physician feels a "gritting" sensation as the articular surfaces rub over each other. When the subluxation of the atlas is reduced by this movement, it will hold its true position more firmly than will any other vertebral articulation which has been affected in a like manner. This is because the condyles of the occiput fit more deeply into the superior articulating surfaces of the atlas then is the case between articulating surfaces of pairs of vertebrae.

Sixth Cervical.—The sixth cervical vertebra is especially difficult to treat. When the cervical muscles are well developed, it is obscured to the touch posteriorly, but the carotid tubercles anteriorly can be felt. It is not wise to exert much pressure upon bony structures from the anterior surface of the neck. There are so many glands, nerves, arteries, etc., lying over the transverse processes, that direct pressure is liable to injure them.

Fig. 150 illustrates a method of reducing a subluxation of the sixth cervical vertebra. The patient's chin rests in the physician's hands, which are placed on each side of the neck and near enough to the chin to support it by the little finger. The thumbs are used to affect the spine directly. The compression of the head and neck above the lesion by both hands keeps them rigid and all are moved together, first to exaggerate the lesion of the sixth, then anterior flexion is forced in the articulation affected, then lateral flexion with counter pressure by the thumb on the prominent side of the spine.

This movement can be applied to subluxations of the first and second dorsal.

CHAPTER XX.

EXTREMITIES.

Treatment of the shoulder for synovial adhesions, ligamentous or muscular contractions consists of movements made in the normal direction, but carried farther than the patient can do so voluntarily.

Diagnosis.—Test the extent of the movements normal to the articulation to ascertain whether the loss of movement is general in all directions or results from impairment of some special muscle or ligament.

Causes of Stiff Joints.— The history of the case will usually give an insight into its cause, progress, etc. The shoulder articulation is frequently stiffened by a sprain, dislocation, muscular and articular rheumatism. The simplest cases are those resulting from rest, necessitated by a broken clavicle or humerus.

The necessary rest after a dislocation gives the strained ligaments an opportunity to shorten and thicken. Movements should be frequently forced in such cases to prevent any synovial adhesions. The differentiation of cases of ankylosis is an important one. It is disheartening to physician and patient alike to find that after weeks of earnest effort no satisfactory results are obtained.

An article on "Ankylosis" by J. S. White, D. O., of Pasadena, Cal., published in Vol. V., No. IV., of *The Osteopath,* page 211, deserves quotation here because it notes so clearly the important points which the student ought to know. With his permission it is quoted in full.

"**Ankylosis.**—When, from an injury, disease or other cause, a joint loses its function and becomes stiff, it is said to be ankylosed. This condition may be termed bony (complete) or fibrous (incomplete), true (intra-articular) or false (extra-articular) ankylosis.

"These are the terms used by Da Costa to define ankylosis, yet some claim that joint-stiffness caused by extra-articular

contraction or obstruction is not ankylosis in the correct sense; but on looking at the derivation of the word (an(g)kulos—crooked or bent), it seems that the term ankylosis would be correct when applied to any form of restricted joint movement."

"The causes of ankylosis are many. First, let us consider those which result in complete and incomplete ankylosis. Inflammations in or around the joint from whatever cause, if continued long enough for new tissue formation, will cause ankylosis. After aseptic inflammations we will most likely find fibrous, but when there is infection, bony ankylosis is more probable."

"This fibrous formation is the result of inflammation, for wherever there is inflammation there is an increase of tissue. Suppose a case of dislocation, with considerable contusion of the tissues around the joint, inflammation results, and embryonic tissue begins to form as a reparative process; the embryonic tissue sends out small processes, which start from new centers and spread through the gelatinous mass, in and around the joint, until a very irregular network is spread all around the joint surface, when the contraction process begins, the new tissue is formed into fibrous tissue, which unites the bones closely together; by cicatricial contraction the bones may be drawn so closely together that movement is almost impossible."

"Bony union of the joint surface follows fibrous ankylosis; it occurs when the bone itself is injured or diseased, and the surface of the bone eroded or broken. Ossification begins chiefly in those layers of fibrous tissue lying next to the bone."

"False or extra-articular ankylosis is caused by the contraction of tissues around the joint. These contractions, external to the joint, may be the result of many remote and obscure causes."

"First. Chronic contraction, which may be due to disease or obstruction to the nerve, at the center, or in its course to the muscles. As the normal action of muscles is dependent on normal nerve stimulus, a muscle may be affected in various ways by the stimulus of an over-irritated or inhibited nerve; excess of nerve stimulation will cause a pathological contrac-

tion, or there may be suspension of nerve stimulus and paralysis of muscles, allowing the opposing muscles to pull and hold the joint in a fixed position."

"Second. Contractions sufficient to cause permanent fixations may follow the healing of wounds, ulcers or abscesses. Active contraction, from any cause, if kept in that state any length of time can cause the muscle to undergo a state of fibroid degeneration; tissue waste is replaced by fat and fibrous material. There is good evidence that, after a time, tissues which have not fulfilled their function lose the ability to do so, and the nutritive changes accompanying vital activity do not take place; the contiguous fibres and cells become adherent, agglutinated, and united by exuded serum and waste material not carried away by the circulation, sluggish through inactivity of the muscles."

"The tendons and ligaments around the joint are thickened and hardened to the length the limb was held by the active contraction, but after the manner of all newly formed tissue it continues to retract and draw the limb more out of its normal position."

"Third. Contractions may be the result of certain diseases(as rheumatism, gout, tuberculosis, syphillis or any disease causing non-use of the joint or mal-nutrition of the controlling muscles."

"In examining an ankylosed joint, we must distinguish between bony and fibrous ankylosis and extra-articular contraction. A joint may be immovable, and yet not so because of bony ankylosis."

"Da Costa says that a joint immovable from fibrous ankylosis is distinguished from a joint immovable from bony ankylosis by the fact that in the former, attempts at motion are productive of pain and subsequently of inflammation; therefore, pain on attempted motion excludes bony ankylosis from our diagnosis. An approximate idea of the extent of the stiffness may be obtained from a history of the case as to whether the disease has been severe in character and long in duration. The nerves of the joint should be examined at their point of exit from the spine and throughout their course to the joint."

"The same conditions, in general, which cause pain in a joint may cause ankylosis, whether that pain be due to local injury or referred from some other part—a contracted psoas muscle by irritation to the branches of the obturator nerve can cause pain, contraction and consequent stiffness of the knee joint."

"What can osteopathy do for this condition? For bony ankylosis nothing should be attempted, for the treatment would only result in discouragement and disappointment to both physician and patient; but if the joint is in an almost useless position, excision or osteotomy may be tried with good results. If the joint has become ankylosed through septic inflammation, it should not be forcibly broken up, because of the danger of re-infection of the whole joint or other parts of the body through the circulation."

"In cases of fibrous and extra-articular ankylosis osteopathy can refer to the most encouraging records, and is undoubtedly ahead of any other method of treatment. The main point in the treatment consists principally in making active the retarded circulation, gradually breaking up the adhesions, thoroughly relaxing all the muscles, and a stimulating treatment to the nerves."

"For extra-articular ankylosis the treatment is varied according to the cause. Osteopathy has a great mission to fill in finding and removing the *primary* cause of many cases of ankylosis. Hilton speaks of a case of diseased (tubercular) knee joint cured by ankylosis. True! the rest and ankylosis was nature's way of reducing the inflammation and disease when it had progressed so far. But the work of the osteopath is to look for the causes which made the knee joint "a point of least resistance" for the tubercle bacilli to multiply in. Examine the spine thoroughly, the sacro-iliac articulation and the hip for dislocations, which cause pain in the knee joint through irritation of the obturator nerve. But does pain alone in the joints lead to the condition known as "a point of least resistance?" Pain prevents much movement in the joint, and remembering that continued non-use of muscles causes malnutrition, sluggish circulation, and degeneration of the mus-

cle, we may see how the joint may become a place for germs to multiply."

"Is it too long a course from simple pain to disease? Remember that pain is usually accompanied by contraction of muscle. Our treatment must be both preventive and curative."

"Following is a case of fibrous ankylosis and paralysis illustrating the efficiency of osteopathy to treat this class of sufferers: Vincent Pete, five years of age, had an ankylosed elbow as a result of a dislocation and break. The joint was attended to immediately after the accident by a regular physician, but was kept in the splints too long, which caused the fibrous ankylosis. The humerus was broken just above the condyles, and a small spicula of bone had protruded so that it interfered with those fibres of the median nerve which supply the flexor muscles of the thumb and forefinger to such a degree that the thumb and forefinger were completely paralyzed as far as the flexor movements were concerned. The forearm was ankylosed almost at a right angle with the arm, and a very little movement could be made, and that with great pain; the muscles in the cervical region of the spine were sore and contracted. This was the condition of the patient when he came for treatment eight weeks after the accident. The improvement began with the first treatment, and in one month the arm was perfectly straight and movable in any direction, and he began to have power of movement in his finger and thumb; at the end of two months' treatment his arm had returned to almost its usual strength and flexibility. I saw him a month later and the arm and hand were perfectly normal. Contrast this case with one treated by mechanical rest, resulting in a fixed elbow joint, or perhaps a moderately useful joint following forcible breaking of adhesion under anaesthesia, which is a dangerous treatment, with very doubtful results, as the operation may have to be done over and over again before a useful joint is gained."

The Scapulo-humeral Articulation.—Fig. 151 illustrates a method of prying the head of the humerus out of the glenoid fossa, i. e., separating the articular surfaces. This

movement can be used in cases of muscular rheumatism when complete abduction of the arm is impossible. It also allows an influx of fresh arterial blood.

When abducting the arm, the scapula must be held by the physician's hands. Place the fingers on the vertebral border of the scapula while the axillary border is compressed by

Fig. 151.—Manner of applying leverage to stretch the structures forming the scapulo-humeral articulation.

the thumb. By holding the scapula securely, the physician is sure that all the movement he forces is in the shoulder articulation, and not the gliding of the scapula on the thorax. The muscles of the arm may be relaxed by direct manipulation. The insertion of the deltoid is frequently tender. Any wasting of the muscles of the extremity should be carefully noted, so that the course of its governing nerve may be searched for a point of compression.

Examination of the Brachial Plexus.—The principal motor divisions of the brachial plexus may be tested by simple movements made by the patient. The patient's gripping power is an index to the condition of the median nerve, and the muscles it innervates. Extension of the forearm, wrist and fingers made against resistance is an index of power in the musculo-spiral nerve tract. Abduction and adduction of the fingers are controlled by the ulnar nerve. Flexion of the forearm by the musculo-cutaneous.

Observe the condition of the first posterior interosseous muscle which forms the little muscular swelling when the thumb is adducted to the second metacarpal bone. If it is wasted there is evidence of nerve cell degeneration. This muscle should be well developed in thin hands as well as in fat ones. If the wasting is uni-lateral, look for impingement on the ulnar nerve at some point in its course. If it is bilateral the cells in the spinal cord are probably at fault.

The deltoid is frequently painful as a result of pressure on the circumflex nerve. The pressure is usually at the point of exit from the vertebral canal. Relaxation of the structures around its point of exit usually relieves.

Reduction of Dislocations by Traction.—The general method applied to dislocations of all joints of the extremities is direct traction. This is sometimes aided by pressure on the prominent point of the dislocated bone to aid it in slipping to its place. All of the dislocations of the humerus, subcoracoid, subclavicular, subglenoid and subspinous, can be reduced by using traction to stretch the muscles and ligaments of the joint to the extent that the head of the humerus will slip over the rim of the glenoid fossa. This traction may be made with the patient sitting, as in Fig. 142. The knee in the axilla springs the head of the humerus outward. The same treatment may be applied with the patient reclining. The physician should place a ball of woolen yarn in the axilla, then place his stockinged foot upon it, and make traction on the arm.

It is possible to apply the traction method in a simpler way. An ordinary canvas cot, with a hole cut in it, so that the arm can be put through while the patient rests easily on his

Fig. 152.—A position for easy manipulation of the scapulo-humeral articulation.

side, should be elevated far enough from the floor to allow a six-pound weight to be attached to the wrist. This steady weight quickly relaxes the muscles and reduces the subluxation.

Traction always strains the muscles and causes some heat

and swelling, therefore, care should be taken to prevent exudates and adhesions.

Reduction of Dislocations by Leverage.—Those who are expert in reducing shoulder dislocations usually make use of a series of movements which exaggerate the lesion, i. e., make the head of the dislocated bone more prominent. In subcoracoid dislocations of the humerus, abduction of the arm causes exaggeration. The physician stands at the side of the patient, who is reclining on a hard surface. As abduction is made, the physician's free hand rests upon the head of the humerus. From the position of abduction the arm is carried inward and forward on a level with the shoulder, at the same time being rotated internally so that the external condyle will be in front of the patient's nose, then carry the arm downward to the side with a quick, vigorous movement, at the same time exerting pressure on the head of the bone as before mentioned. This series of movements must be made quickly, and the pressure on the head of the bone be most intense while the internal rotation and adduction are at the maximum.

This series of movements may be employed to break up synovial adhesions.

Elbow Dislocations.—Elbow dislocations are infrequent compared to those of ball and socket joints. The possible dislocations of the ulna are lateral and posterior. The former require traction, the latter is reduced by placing the bend of the patient's elbow over the physician's knee. Traction with one hand on the patient's wrist while the other hand makes pressure on the olecranon will force the ulna into place. This dislocation is usually complicated with fracture of the coronoid process.

The Radius.—The radius may be dislocated posteriorly or anteriorly. Lateral dislocations of either radius or ulna carry both bones together. A posterior dislocation of the radius can be reduced by flexion of the forearm, then extension with counter pressure on the prominent point of the head of the radius posteriorly. A forward dislocation requires supination of the arm and adduction of the hand, together with pressure on the anterior surface of the head of the radius.

Dislocations of the bones of the wrist or hand are reduced by traction or pressure.

Old Dislocations.—All dislocations twenty-four hours old require considerable relaxing treatment. The older they are, the harder they are to reduce. Nature begins to adapt herself to new conditions almost immediately. All the slack of muscles and ligaments is swiftly taken up. Those tissues most compressed by the new position of the bone are impover-

Fig. 153.—Relaxation of the quadriceps extensor.

ished by the lack of nourishment. Thickenings and adhesions quickly form, so that old dislocations are not easily handled. Old dislocations are treated in the same manner as fresh ones, except that much relaxing and restoring of vitality is necessary.

Muscles of the Lower Extremity.—The muscles of the lower extremity may be relaxed either by direct manipulation or by taking advantage of the movement of various joints to put them on a stretch. Direct manipulation is laborious and requires considerable time.

The muscles of the hip joint frequently contract sufficiently to make walking difficult. They contract as a result of strain, bruise, disease of the joint, subluxation of lumbar vertebrae, or luxation of the iliac bones. The subluxations irritate the nerves which innervate the muscles controlling the joint.

The movements hereafter outlined may be used for many different purposes, but they are applied here to specific groups of muscles. All the movements we have thus far outlined have been described according to the way they affect structure, not function.

Fig. 154.—Relaxation of the quadriceps extensor—sacro-vertebral articulation allowed to remain moveable.

the thigh is innervated by the anterior crural nerve. In order

Quadriceps Extensor.—The quadriceps extensor of to stretch this muscle the patient should lie face downward. The physician grasps the patient's ankle with the left hand as in Fig. 153. The right hand holds the pelvis to the table. Lifting with the left hand puts the muscle on a tension which can be easily increased by flexing the knee.

This movement stretches the fascia over Poupart's ligament and the saphenous opening.

Fig. 154 illustrates a similar movement to the preceeding, but it is not so powerful. When the patient lies on the side, his back bends to the force of the movement of the leg. If the physician grips the ankle instead of the knee there is a great increase in the effect of the movement.

The Adductor Group.—The adductor group of thigh muscles innervated by the obturator nerve, can be stretched as in Fig. 155. If there is any inflammation in the acetabulum,

Fig. 155.—Relaxation of the adductor muscles of the thigh.

this movement will cause the patient great distress, because it stretches the teres ligament.

Dislocation of the Femur.—Dislocations of the hip joint are usually caused by the forcible spreading of the legs. The head of the femur is thus forced over the edge of the acetabulum at its dependent and weakest part, the cotyloid notch. It passes into the thyroid foramen, and if it remains there all the muscles are stretched very tight, and no voluntary movement is possible. The direction the head takes is dependent on the direction of the force. If the knee points anteriorly at the time of the forced extreme abduction, the head after

entering the thyroid foramen passes out of it posteriorly and takes a position over the spine of the ischium, great sciatic foramen or outer surface of the ilium, all owing to the vigorous pulling of the muscles. If the knee points posteriorly, the head of the femur travels to a position under the anterior inferior spine of the ilium.

The movements made to reduce these subluxations take into consideration the fact that the head of the femur must be made to retrace its route in order to regain its proper position.

Fig. 156.—Method of stretching the sciatic nerve.

For example, a dislocation posteriorly on to the spine of the ischium causes the toe to turn inward, and there is slight shortening of the leg. The physician takes a position as in Fig. 157 and carries the knee upward and inward. He forces the knee as far as possible across the median line, then flexes the thigh hard on the abdomen. This turns the head of the femur downward and inward. Remember that the head points always in the same direction as the internal condyle. Now forcibly abduct and extend the thigh with a quick external rotation. These movements cannot be made successfully without a long

course of preliminary relaxing treatments, that is, if the dislocation is an old one.

Direct traction may be used for all dislocations of the femur just as for the shoulder, but the muscles are so strong that it is no small matter to overcome them, hence movements which take advantage of leverage are much more satisfactory.

The formula for any dislocation of the hip may be worked out by noting the position of the head of the femur and then carrying the internal condyle so as to make the head retrace its

Fig. 157.—Relaxation of the pyriformis.

course. When shortening or lengthening of the leg is noted, make sure that the iliac bones are even. A half-inch difference in them may easily be accounted for by the action of the hip muscles.

The pyriformis muscle may contract and compress the sciatic nerve in its course through the great sciatic foramen. Fig. 157 illustrates the movement to stretch the pyriformis. The physician holds the pelvis to the table by pressing on the anterior superior spine of the ilium. The thigh is then strongly adducted.

Stretching the Sciatic Nerve.—Sciatica is frequently successfully treated by relaxing the pyriformis, but the major-

ity of cases require a stretching of the sciatic nerve, which is performed as in Fig. 157. The physician has great leverage in this movement. It stretches all the flexor group on the back of the thigh.

The Calf Muscles.—The calf muscles sometimes contract and make it difficult for the patient to get the heel to the floor. Fig. 158 illustrates the method of applying leverage to the case.

Fig. 158.—Method of stretching the deep and superficial muscles on the back of the leg.

Scientific Manipulation.—Every group of muscles in the body can be relaxed by stretching them, hence if the student will study their attachments and the effects of their normal contraction, a series of movements can be devised to suit the condition. Learn anatomy in a practical manner and a system of osteopathic movements will spring forth from the understanding mind of the student. The author has tried the plan of not demonstrating movements to students, but putting the whole attention to understanding the conditions in the patient which require treatment. A study of the mechanical difficulties presented and the comparison of these with the normal relations leads the student to apply anatomical knowledge in treatment. If the student understands the case, that is, realizes the significance of the points found by the physical diagnosis he can be depended upon to apply a rational method of treatment. As

soon as the student makes a movement in a certain manner in order to copy his instructor instead of basing it on his own understanding of the condition treated, he degenerates to mere empirical methods.

Saphenous Opening.—The circulation in the lower extremity is frequently affected on the venous side by tension at the saphenous opening. Enlargement of the superficial veins of the leg above a point three or four inches above the ankle

Fig. 159.—Position for easy manipulation of the saphenous opening.

denotes obstruction to free blood flow in the long saphenous vein. Abduction and extension of the thigh will stretch the fascia forming the saphenous opening, then place the thigh in a semi-flexed position, as in Fig. 159, to facilitate direct manipulation of the tissues forming this opening. The deep and superfical veins of the leg have little or no communication above a point about the junction of the lower and middle third of the leg. This applies especially to the long saphenous vein. Varicose veins on the feet or ankles may be drained by both superficial and deep veins, therefore, their existence in these

Fig. 160.—Position for easy manipulation of the popliteal space.

locations may be due to visceral causes, even when there is no obstruction to the saphenous opening.

Popliteal Space.— The popliteal space sometimes needs relaxation. This is performed by direct manipulation as illustrated in Fig. 160. The position of the physician's hands in this illustration affect the upper portion of the popliteal space. By facing the patient the lower portion can be easily affected.

CHAPTER XXI.

MANIPULATION FOR VASO-MOTOR NERVE EFFECTS.

There are times when the physician desires to affect the amount of blood in the tissues of the head. There may be a congestion of the nasal, pharyngeal and laryngeal mucosa as during a hard "cold." The condition has come on as a result of thermal stimuli. After manipulating to relax the muscles of

the neck and overcome any effects these may have had on the position of the cervical vertebrae, it is well to try to cause vaso-constrictor action by stimulating nerve endings. Fig. 161 illustrates a method of stimulating deeply under the zygoma in the sigmoid notch of the inferior maxillary bone. When the patient opens his mouth, the physician places his finger over the

Fig. 161.—Stimulation between the zygoma and the sigmoid notch of the inferior maxilla.

depression below the zygoma and presses inward, at the same time, making a vibratory movement of the finger. This affects the branches of Meckel's Ganglion and through it the nasal mucosa. It is a painful treatment, but the blood will often surge from the mucous tissues to the skin as a result of it.

About the same effect is secured by using the movement illustrated in Fig. 162. While the patient's mouth is open, the physician places his thumbs on the bridge of the nose, and his

Fig. 162.—Stimulation by forcible closure of the mouth against resistance.

fingers at the angles of the jaw. The tips of the little and ring fingers are pressed into the depression caused by the forward movement of the condyle of the jaw on the eminentia articularis. The physician forces the mouth shut while the patient opposes. The position of the tips of the little and ring fingers prevents the easy slipping of the condyles into the glendoid fossa. The sensory fibres around the condyle are intensely stimulated and frequently manifest it by spreading a flood of color over the face in front of the ear. This is also a painful stimulation. It is highly probable that all movements of this character which are painful secure results by causing activity of the dilator nerves to blood vessels in superficial tissues, thus depleting the blood in the congested area. A sharp pain may cause a sudden blanching, but it is followed by vaso-dilation.

If it is difficult for the patient to breathe through the nostrils, press on the nasal bones, first on the right side, then left, then make a heavy pressure over the junction of the nasal and frontal bone with one thumb above the other. This movement is very pleasant to the patient ordinarily.

To carry off the venous blood, make a stroke from the

Fig. 163—Points of exit of divisions of the fifth cranial nerve.

inner canthus of the eye downward over the junction of the masseter muscle with the lower jaw, thence to the supra-clavicular fossae.

The Fifth Cranial Nerve.— The fifth cranial nerve can be treated at its points of exit through the bones of the face. Fig. 163 illustrates the position of these points. A vibratory pressure over these points causes a dull but increasing pain.

If the movement is made quickly and vigorously, there will be evidence of a reaction in a flushed appearance.

Inhibition of Suboccipital.—When there is a high blood pressure in the head and the patient is suffering with headache it is possible to give great relief by steadily inhibiting in the suboccipital fossae and temples, as illustrated by Fig. 164. All nervous conditions are greatly reduced by this movement.

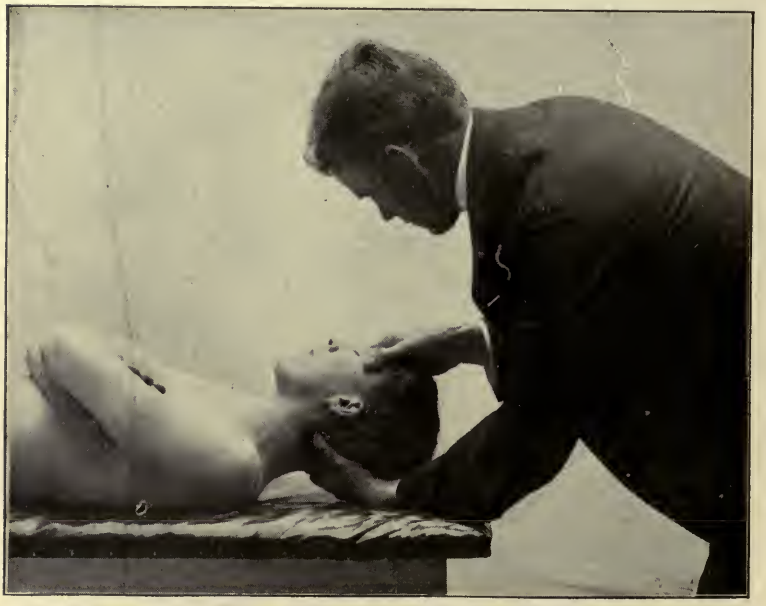


Fig. 164.—Inhibition in the suboccipital fossae.

The inhibition reduces the number of sensory impressions, and lessens the tension of blood vessels all over the body. This inhibitory movement should be used in cases of epilepsy and delirium tremens during the excitable stages. Have an assistant inhibit in the splanchnic area, thus causing a general reduction of blood pressure in the superficial and deep tissues of the body and extremities. The blood is thus drawn away from the head, and the patient becomes quiet.

To inhibit the transmission of impulses to the diaphragm

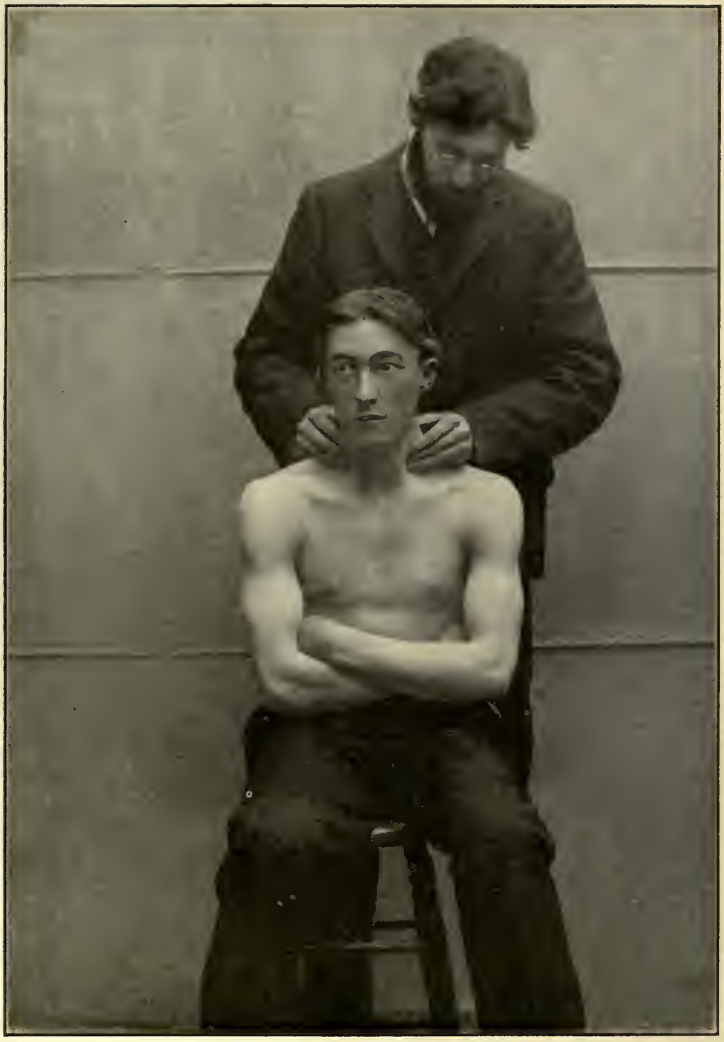


Fig. 165.—Inhibition of the phrenic nerves—center for hiccough.

by the phrenic nerves pressure should be made as in Fig. 165. The physician's fingers compress the phrenic nerve against the scalenus anticus.

The phrenic, pudic and pneumogastric are the only nerve

Fig. 166.—Stimulation of the pneumogastric nerves.

trunks distributed in the body which can be easily compressed through soft tissue. Fig. 166 illustrates stimulation of the pneumogastric. The physician's fingers roll over the nerve trunk where it lies along the inner edge of the sterno-cleido-mastoid.

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